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A

HISTORY

OF

INVENTIONS AND DISCOVERIES.

BY JOHN BECKMANN,

Public Professor of Economy in the University of Gottingen.

TRANSLATED FROM THE GERMAN,

BY WILLIAM JOHNSTON.

VOL. I.

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ERRATA.

VOL. I.

P. 3, first note, l. 6, *for* omnem pene mathematicæ, *read* omnem pene rationem mathematicæ.
P. 65, l. 10, *after* Italians alone, *read* for a long time.
P. 101, in the note, l. 2, *for* Dauphin, *read* Dauphinefs.
P. 117, in the fourth note, *for* Kink, *read* Rink.
P. 118, l. 10, *for* Churmark archives, *read* archives of the county of Mark.
P. 180, note 3, l. 4, *for* fathoms, *read* cubits.
P. 186, line 4 from the bottom, *for* 1560, *read* 1650.
P. 200, laft line, *for* beft flint, *read* beft frit.
P. 229, l. 10, *for* heavy mortar, *read* heavy peftle. *Ibid.* note 2, *for* παυσικακη, *read* παυσικαπη.
P. 363, laft line, *for* Ifiodorus, *read* Ifidorus.
P. 411, l. 2, *for* Martin Zeller, *read* Martin Zeiler.

TRANSLATOR's PREFACE.

THAT the arts had their riſe in the Eaſt, and that they were conveyed thence to the Grecks, and from them to the Romans, is univerſally admitted. Reſpecting the inventions and diſcoveries however of the early ages, nothing certain is known. Many of thoſe moſt uſeful in common life muſt have been the production of periods when men were little acquainted with letters, or any ſure mode of tranſmitting an account of their improvements to ſucceeding generations. The taſte which then prevailed of giving to every thing a divine origin rendered traditional accounts fabulous; and the exaggeration of poets tended more and more to make ſuch authorities leſs worthy of credit. A variety of works alſo, which might have ſupplied us with information on this ſubject, have been loſt; and the relations of ſome of thoſe preſerved are ſo corrupted and obſcure, that the beſt commentators have not been able to illuſtrate them. This in particular is the caſe with many paſſages in Pliny, an author who appears to have collected with the utmoſt diligence whatever he thought uſeful or curious, and whoſe deſire of communicating knowledge ſeems to have been equal to his thirſt for acquiring it.

Of all thoſe nations whoſe hiſtory has been preſerved, the moſt diſtinguiſhed are certainly the Greeks and the Romans; but, as far as can be judged at this remote period, the former were ſuperior to the latter in point of invention. The Romans indeed ſeem to have known little, except what they borrowed from the Grecians; and it is evident, by their ſending their young men of rank to finiſh

their education in Greece, that they conſidered that country as the ſeat of the arts and the ſciences, and as a ſchool where genius would be excited by the fineſt models, while the taſte was corrected and formed. From ſome hints given however by Pliny and other writers, we have reaſon to conclude that the Romans poſſeſſed more knowledge of the arts than the moderns perhaps are willing to allow, and that ſome inventions, conſidered as new, may be only old ones revived and again rendered uſeful.

When Rome, abandoned to luxury and vice, became an eaſy prey to thoſe hordes of barbarians who overran the empire, her arts ſhared in the general wreck, and were either entirely loſt, or for a time forgotten. The deplorable ſtate of ignorance in which Europe was afterwards plunged during ſeveral centuries, retarded their revival; and it was not till a late period, when favoured and protected by a few men of ſuperior genius, that they began to be again cultivated. It cannot however be denied, that ſeveral important diſcoveries, altogether unknown to the ancients, which muſt have had conſiderable influence on the general ſtate of ſociety, were made in ages that can hardly be exempted from the appellation of barbarous. As a proof of this may be mentioned the invention of paper*,

* Montfaucon, notwithſtanding all his reſearches in France and Italy, was not able to diſcover any charter or diploma written on common paper, older than the year 1270. Paper, however, made of cotton, is ſaid to be much older, and to have been introduced into Europe by the Arabs. If we can believe an Arabian author, who wrote in the thirteenth century, quoted by Caſiri, in *Biblioth. Arabico-Hiſpana*, vol. ii. p. 9, paper (doubtleſs of cotton) was invented at Mecca by one Joſeph Amru, about the year of the Hegira 88, or of the Chriſtian æra 706. According to other Arabian authors, quoted by Caſiri and Abulfeda, the Arabs found a manufactory of paper at Samarcand in Bucharia, when they conquered that country in the year of the Hegira 85, or of our æra 704. The art of making paper from ſilk was, as ſome pretend, known to the Chineſe 180 years before Jeſus Chriſt. See a letter from Father de Mailla to Father Etienne Souciet, in *Mémoires des inſcript. et des belles lettres*, vol. xv. 520.

painting on oil *, the mariner's compaſs †, gun-powder ‡, printing ‖, and engraving on copper §. After the invention of

* The oldeſt picture, known at preſent, painted in oil-colours on wood is preſerved in the imperial gallery at Vienna. It was painted in the year 1297, by a painter named Thomas de Mutina, or de Mutterſdorf, in Bohemia. Two other paintings in the ſame gallery are of the year 1357; one of them is by Nicholas Wurmſer of Straſburg, and the other by Thierry of Prague. It appears therefore that painting in oil was known long before the epoch at which that invention is generally fixed; and that it is erroneouſly aſcribed to Hubert van Eyck and his brother and pupil, John van Eyck, otherwiſe called John of Bruges, who lived about the end of the fourteenth century, and not the beginning of the fifteenth, as is commonly ſuppoſed.

† The perſon who firſt ſpeaks of the magnetic needle and its uſe in navigation, is a Provençal poet, who lived in the beginning of the thirteenth century, and who wrote a poem entitled *Bible Guyot*. This work is a ſatire, in which the author laſhes with great freedom the vices of that age Comparing the Pope to the polar ſtar, he introduces a deſcription of the compaſs, ſuch as it appears to have been in its infancy. This invention however is claimed by the Italians, who maintain that we are indebted for it to a citizen of Amalphi, named Flavius Gioja, and in ſupport of this aſſertion quote commonly the following line of Panormitanus:

Prima dedit nautis uſum magnetis Amalfis.

‡ Of the uſe of gun-powder in Europe no certain traces occur till towards the middle of the fourteenth century. It ſeems pretty well proved, that artillery was known in France after the year 1345. In 1356, the city of Nuremberg purchaſed the firſt gun-powder and cannon. The ſame year the city of Louvain employed thirty cannon at the battle of Santfliet againſt the Flemings. In 1361, a fire broke out at Lubec, occaſioned by the negligence of thoſe employed in making gun-powder. In 1363, the Hanſe-towns uſed cannon for the firſt time, in a naval combat which they fought againſt the Danes. After 1367, the uſe of fire-arms became general throughout Italy, into which they had been introduced from Germany.

‖ The invention of printing has given riſe to many reſearches. Meermann in his *Origines Typographicæ*, publiſhed in 1768, endeavours to

of the compaſs and printing, two grand ſources were opened for the improvement of ſcience. In proportion as navigation was extended, new objects were diſcovered to awaken the curioſity and excite the attention of the learned; and the ready means of diffuſing knowledge, afforded by the preſs, enabled the ingenious to make them publicly known. Ignorance and ſuperſtition, the formidable enemies of philoſophy in every age, began ſoon to loſe ſome of that power which they had uſurped; and ſtates, forgetting their former blind policy, adopted improvements which their prejudice had before condemned.

Though it might be expected that the great ſhare which new inventions and diſcoveries have at all times had in effecting ſuch happy changes among mankind, would have ſecured them a diſtinguiſhed place in the annals of nations; we find with regret, that the pen of hiſtory has been more employed in recording the crimes of ambition and the ravage of conquerors, than in preſerving the remembrance of thoſe who, by improving ſcience and the

prove that Laurence Coſter of Harlem was the inventor about the year 1430. Moſt authors however agree that John Gutenberg was the inventor of moveable types, but they differ reſpecting the place of the invention. Some make it to be Straſburgh, others Mentz, and ſome fix the epoch of the invention at 1440, and others at 1450.

§ Vaſari, in *Vite de' Pittori*, vol. iv. p. 264, aſcribes the invention of engraving on copper to a goldſmith of Florence, named Maſo Finiguerra, about 1460. The oldeſt engravers whoſe names and marks are known, were Iſrael de Mecheln, of Bokholt in the biſhopric of Munſter; Martin Schœn, who worked at Colmar in Alſace, where he died in 1486; and Michael Wolgemuth of Nuremberg, who was preceptor to the famous Albert Durer. It may be proper here to obſerve, that the art of engraving on wood ſeems to be older than the invention of printing, to which perhaps it gave riſe. The names of the firſt engravers on wood are however not known.

arts,

arts, contributed to increaſe the conveniencies of life, and to heighten its enjoyments. So little indeed has hitherto been done towards a hiſtory of inventions and diſcoveries, that the riſe and progreſs of part of thoſe even of modern times is involved in conſiderable darkneſs and obſcurity *: of ſome the names of the inventors are not ſo much as known, and the honour of others is diſputed by different nations; while the evidences on both ſides are ſo imperfect, that it is almoſt impoſſible to determine to which the palm is due. To profeſſor Beckmann, therefore, thoſe fond of ſuch reſearches are much indebted for the pains he has been at to collect information on this ſubject; and though he has perhaps not been able to clear up every doubt reſpecting the objects on which he treats, he has certainly thrown much light on many curious circumſtances hitherto buried in oblivion.

The author, with much modeſty, gives to this work in the original the title of only *Collections towards a Hiſtory of Inventions:* but as he has carefully traced out the riſe and progreſs of all thoſe objects which form the ſubject of his enquiry, from the earlieſt periods of their being known, as far as books ſupplied information, and arranged his matter in chronological order, the original title may admit, without being liable to much criticiſm, of the ſmall variation adopted in the tranſlation. The author, indeed, has not in theſe volumes comprehended every invention and diſcovery, but he has given an account of a great many, moſt of them very important; and it is not improbable that his labours in this reſpect may be continued.

* The authors who treat expreſsly on this ſubject are not numerous. We have Polydore Virgil, Pancirollus and his commentator Salmuth, D'Origny and a few others; but the information they give is very limited and defective.

Should

Should that be the caſe, and ſhould the preſent work be favourably received, the reſt of the original, when a ſufficiency is publiſhed to form another volume, will be tranſlated, and preſented to the public in the like manner.

Should any one be diſpoſed to find fault with the author for introducing into his work ſome articles which on the firſt view may appear trifling, his own words, taken from the ſhort preface prefixed to the firſt volume of the original, will perhaps be conſidered as a better exculpation than any thing the tranſlator might advance in his favour. "I am ſenſible," ſays he, "that many here will "find circumſtances which they may think unworthy of "the labour I have beſtowed upon them; but thoſe who "know how different our judgments are reſpecting uti-"lity, will not make theirs a rule for mine. Thoſe whoſe "ſelf-conceit would never allow them to be ſenſible of this "truth, and who reject as uſeleſs all ore in which they do "not obſerve pure gold, as they diſplay very little acute-"neſs, muſt be often duped by the tinſel glare of falſe "metal; and they give me as little uneaſineſs as thoſe "who have no deſire to know the origin of inventions, "or how they were brought to their preſent utility. If "my extending the term Invention farther than is perhaps "uſual, by comprehending under it ſeveral police-eſta-"bliſhments, be a fault, it is at any rate harmleſs, and "on that account may be pardoned without much apo-"logy."

Germany, beyond all diſpute, has given birth to more important diſcoveries and inventions than any other part of Europe; and gun-powder, printing, and a variety of uſeful machines, will remain laſting monuments of the inventive genius of the Germans. In chemiſtry and mechanics

chanics they ſeem however to have made the greateſt figure, and for this a very ſatisfactory reaſon may be aſſigned. Germany, ſince the earlieſt periods, has been celebrated for its mines. To facilitate the labour of working theſe, machinery was neceſſary; and to extract the metal from the ore, and turn it to advantage, required a knowledge of chemical operations. Neceſſity is ſaid to be the mother of invention; and it is natural to ſuppoſe that a people will always employ the efforts of their genius on thoſe objects from which they are moſt likely to derive benefit.

In the hiſtory of chemical diſcoveries and mechanical inventions, above all, profeſſor Beckmann has enjoyed, therefore, an advantage which might have been wanting to a writer of any other nation. It will require no great ſagacity to diſcover, that alluſion is here made to the opportunities he had of conſulting many German works, little or perhaps not known in other parts of Europe, and of ſearching ancient annals and public records never before drawn from their obſcurity to give teſtimony in favour of the arts. He indeed ſeems to have applied to every ſource that was likely to enrich his ſubject; and the voluntary contributions of learned friends enabled him to enlarge his work with much uſeful information, for which he expreſſes on ſeveral occaſions his grateful acknowledgment.

The German original made its appearance in ſeparate parts at various times; and the whole as yet publiſhed, a few ſmall articles excepted, is now preſented to the public in an Engliſh dreſs. The different articles in the tranſlation are not placed exactly in the ſame order as in the original; but as they were arranged by the author neither alphabetically nor chronologically, this difference is of very little importance to the reader.

As

As the original was publiſhed in parts at different times, the author, when he found materials, gave additions to a few of the articles in ſome of the ſubſequent parts. In the tranſlation theſe additions are incorporated into the articles to which they belong, and, the tranſlator flatters himſelf, in ſuch a manner as the author intended. The tranſlator muſt obſerve alſo, that he has taken the liberty to abridge the original in a few places where he thought it neceſſary, and to give ſome of the text in the form of notes. The paſſages omitted were for the moſt part dry etymological reſearches which could not have been well underſtood except by thoſe verſed in the German language; and the parts of the text now to be found among the notes muſt undoubtedly appear to every reader of taſte much better diſpoſed in that manner than as they were in the original. The tranſlator has likewiſe occaſionally added a few notes, which, to thoſe who read for improvement, may not appear ſuperfluous.

A work of this nature, comprehending ſuch a variety of ſcientific ſubjects, could not but preſent difficulties to the tranſlator. The abundance of technical terms, not to be found in common dictionaries, which every where occurred, and the numerous notes and illuſtrations neceſſary to be preſerved, rendered his taſk, indeed, both arduous and irkſome. How far he has ſucceeded, it becomes not him to determine. He has often appeared in the ſame humble character before the tribunal of the public, and he has the ſatisfaction of reflecting, that he never found cauſe to be diſſatisfied with the reception given to his labours. He truſts therefore, that he ſhall ſtill meet with the ſame indulgence, and that the preſent performance, if entitled to no praiſe, may, at leaſt, be allowed to rank among others of the like kind which deſerve no cenſure.

HISTORY

OF

INVENTIONS.

ITALIAN BOOK-KEEPING.

THOSE who are acquainted with the Italian method of book-keeping muſt allow that it is an ingenious invention; of great utility to men in buſineſs; and that it has contributed to extend commerce and to facilitate its operations. It requires little leſs attention, reflection and accuracy, than many works which are ſtyled learned; but it is undoubtedly true that moſt mercantile people, without knowing the grounds of the rules on which they proceed, conduct their books in as mechanical a manner as many of the literati do their writings.

The name, Italian book-keeping, *Doppia ſcrittura*, with ſeveral words employed in this branch of ſcience and ſtill retained in all languages, make it probable that it was invented by the Italians,

and that other nations borrowed it, as well as various ſhort methods of reckoning, from their mercantile houſes, at the time when all the Eaſt India trade paſſed through Italy.

De la Porte ſays *, "About the year 1495, "brother Luke an Italian publiſhed a treatiſe of "it in his own language. He is the oldeſt author "I have ſeen upon the ſubject." Anderſon, in his Hiſtorical and chronological deduction of the origin of commerce †, gives the following account: "In all probability, this art of double-"entry accounts had its riſe, or at leaſt its revival, "amongſt the mercantile cities of Italy: poſſibly "it might be firſt known at Venice, about the time "that numeral algebra was taught there; from the "principles of which ſcience double-entry, or "what we call merchants accounts, ſeems to have "been deduced. It is ſaid that *Lucas de Burgo*, "a friar, was the firſt European author who "publiſhed his algebraic work at Venice, anno "1494."

This author, who was one of the greateſt mathematicians of the fifteenth century, and who is ſuppoſed to be the firſt perſon who acquired a knowledge of algebra from the writings of the Arabians, was called Lucas Paciolus, e Burgo S. Sepulchri. He was a Franciſcan, and ſo ſurnamed from a town

* La ſcience des négocians et teneurs de livres, Paris 1754. 8vo. p. 12.

† Vol. i. p. 408.

in

in the duchy of Urbino, on the Florentine confines, called Burgo S. Sepulchro*.

Anderſon tells us †, that he had, in his poſſeſſion, the oldeſt book publiſhed in England in which any account is given of the method of book-keeping by double-entry. It was printed at London, in 1569, in folio. The author, whoſe name is James Peele, ſays, in his preface, that he had in-

* In Scriptores ordinis Minorum, quibus acceſſit ſyllabus eorum qui, ex eodem ordine, pro fide Chriſti fortiter occubuerunt—Recenſuit Fr. Lucas Waddingus, ejuſdem inſtituti theologus, Romæ 1650, fol. a work reckoned by Beyer, Vogt, and others, among the very ſcarce books, is the following information, p. 238, reſpecting this author: "Lucas Paciolus e Burgo S. Sepulchri, prope fines Etruriæ, omnem pene mathematicæ diſciplinæ Italica lingua complexus eſt; conſcripſit enim De divina proportione compendium; De arithmetica; De proportionibus et proportionalitalibus; opus egregium et eruditum, rudi tamen Minervâ, ad Guidobaldum Urbini ducem. De quinque corporibus regularibus; De majuſculis alphabeti litteris pingendis; De corporum ſolidorum et vacuorum figuris, cum ſuis nomenclaturis. Excuſa ſunt Venetiis anno 1509. Tranſtulit Euclidem in linguam Italicam, et alia ejuſdem ſcientiæ compoſuit opuſcula." The ſame account is given in Bibliotheca Umbriæ, ſive De ſcriptoribus Umbriæ, auctore Ludovico Jacobillo. Fulginiæ 1658. 4to. p. 180. The oldeſt works of this author, as mentioned in Origine e progreſſi della ſtampa, o ſia dell' arte impreſſoria, e notizie dell' opere ſtampate dall' anno 1457 ſino all' anno 1600. Bologna 1722. 4to. to the dedication of which is ſubſcribed Pellegrino Antonio Orlandi, are Fr. Lucæ de Burgo S. Sepulchri Arithmetica et geometria, Italice; characteribus Goth. Ven. 1494. fol. Liber de algebra. Ven. 1494. This is the work quoted by Anderſon. Thoſe who are deſirous of farther information reſpecting Lucas de Burgo, may conſult Heilbronneri Hiſtoria matheſeos univerſæ Lipſiæ 1742. 4to. p. 520. Hiſtoire des mathematiques, par M. Montucla, Paris 1758. 4to. t. i. p. 441—476. Hiſtoire des progrès de l'eſprit humain dans les ſciences exactes, par Saverien. Paris 1766. 8vo. p. 18 et 38.

† Vol. i. p. 409.

ſtructed many mercantile people in this art, which had been long practiſed in other countries, though in England it was then undoubtedly new. One may readily believe, that Mr. Anderſon was not ignorant of the difference between the method of book-keeping by ſingle, and that by double-entry; but he produces nothing to induce us to believe that Peele taught the latter, and not the former; for what he ſays of debit and credit is of no importance, as it may be applied alſo to the method by ſingle-entry.

Of this Peele no mention is made in Ames' Typographical antiquities; but in that work * there is an account of a ſtill older treatiſe of book-keeping, entitled *A briefe inſtruction and manner how to keepe bookes of accompts, after the order of debitor and creditor, and as well for proper accompts, partible, &c. by three bookes, named the memoriall, journall, and leager. Newly augmented and ſet forth by* John Mellis ſchole maiſter. London 1588. 12mo. Mellis, in his preface, ſays that he is only the re-publiſher of that treatiſe, which was before publiſhed at London in 1543 by a ſchoolmaſter named Hugh Oldcaſtle. From the above title, and particularly from the three accompt books mentioned in it, I am inclined to believe that this work contained the true principles of book-keeping by double-entry.

The oldeſt German work on book-keeping by

* P. 410.

double-

double-entry, with which I am at preſent acquainted, is one written by John Gotlieb, and printed at Nuremberg, by Frederick Peypus, in 1531*. The author, in his preface, calls himſelf a citizen of Nuremberg, and ſays, that he means to give to the public a clear and intelligible method of book-keeping, ſuch as was never before publiſhed. It appears, therefore, that he conſidered his book as the firſt of the kind ever publiſhed in Germany.

It is worthy of remark, that, even at the end of the ſixteenth century, the Italian method of book-keeping began to be applied to finances and public accompts. In the works of the celebrated Simon Stevin, publiſhed at Leyden in Dutch, and the ſame year in Latin, we find a ſyſtem of book-keeping, as applied to finances, drawn up it appears for the uſe of Maurice prince of Orange. To this treatiſe is prefixed, in Dutch and Latin, a dedication to the duke of Sully, in which the author ſays, that his reaſon for dedicating the work to Sully was, becauſe the French had paid the greateſt attention to improve the method of

* The whole title runs thus: Ein Teutſh verſtendig Buchhalten fur herren oder geſellſchafter inhalt welliſchem proceſs, des gleychen vorhin nie der jugent is furgetragen worden, noch in druck kummen, durch Joann Gotlieb begriffen und geſtelt. Darzu etlich unterricht fur die jugent und andere, wie die poſten ſo aufs teglichen handlung flieſſen und furfallen, ſollen im jornal nach kunſtlicher und buchhaltiſcher art gemacht, eingeſchrieben und nach malſs zu buch gepracht werden, Cum gratia et privilegio. Laus Deo.

keeping public accompts. The work begins with a converſation, which took place between Stevin and prince Maurice, reſpecting the application of book-keeping to public accompts, and in which he explains to the prince the principles of mercantile book-keeping. This converſation commences with explaining the nature of debit and credit, and the principal accompts. Then follow a ſhort journal and ledger, in which occur only the moſt common tranſactions; and the whole concludes with an account of the other books neceſſary for regular book-keeping, and of the manner of balancing. Stevin expreſsly ſays, that prince Maurice, in the year 1604, cauſed the treaſury accounts to be made out after the Italian method, by an experienced book keeper, with the beſt ſucceſs; but how long this regulation continued I have not been able to learn. Stevin ſuppoſes, in this ſyſtem, three miniſters, and three different accounts: a *quæſtor*, who receives the revenues of the domains; an *acceptor*, who receives all the other revenues of the prince; and a *theſaurarius* (treaſurer), who has the care of the expenditure. All inferior offices for receiving or diſburſing are to ſend from their books monthly extracts, which are to be doubly entered in a principal ledger; ſo that it may be ſeen at all times, how much remains in the hands of each receiver, and how much each has to collect from the debtors. One cannot help admiring the ingenuity

nuity of the Latin tranſlator *, who has found out, or at leaſt invented, words to expreſs ſo many new terms unknown to the ancient Romans. The learned reader may, perhaps, not be diſpleaſed with the following ſpecimen. Book-keeping is called *apologiſtica* or *apologiſmus*; a book-keeper *apologiſta*; the ledger *codex accepti expenſique*; the caſh-book *arcarii liber*; the expence-book *impenſarum liber*; the waſte-book *liber deletitius*; accounts are called *nomina*; ſtock account *ſors*; profit and loſs account *lucri damnique ratiocinium*, *contentio* or *ſortium comparatio*; the final balance *epilogiſmus*; the chamber of accounts, or counting-houſe, *logiſterium*, &c.

In the end of this work Stevin endeavours to ſhew that the Romans, or rather the Grecians (for the former knew ſcarcely any thing but what the latter had diſcovered), were, in ſome meaſure, acquainted with book-keeping, and ſupports his conjecture by quoting Cicero's oration for Roſcius. I confeſs that the following paſſage in Pliny, *Fortunæ omnia expenſa, huic omnia feruntur accepta, et in tota ratione mortalium ſola utramque paginam facit* †, as well as the terms *tabulæ accepti et expenſi*; *nomina tranſlata in tabulas*, ſeem to indicate that the Romans entered debit and credit in their books, on two different pages; but it appears to me not

* Bayle ſays, that the Latin tranſlation of Stevin's works was executed principally by Willebrord Snellius.

† Lib. ii. cap. 7.

yet proved, and improbable, that they were acquainted with our ſcientific method of book-keeping; with the mode of opening various accompts; of comparing them together, and of bringing them to a final balance. As bills of exchange and inſurance were not known in the commerce of the ancients, the buſineſs of merchants was not ſo intricate and complex, as to require ſuch a variety of books and accounts as is neceſſary in that of the moderns.

Klipſtein is of opinion that attempts were made in France to apply book-keeping, by double-entry, to the public accounts, under Henry IV, afterwards under Colbert, and again in the year 1716. That attempts were made, for this purpoſe, under Henry IV, he concludes from a work entitled *An inquiry into the finances of France*; but I do not know whether what the author ſays be ſufficient to ſupport this opinion.

Thoſe who have paid attention to the ſubject of finances know that, for twenty or thirty years paſt, mercantile book-keeping has begun to be employed at Vienna, in order to facilitate the management of public accounts, which in latter times, and in large ſtates, have been ſwelled to a prodigious extent. For this improvement we are indebted to ſeveral works, ſome of them expenſive, intended as introductions to this ſubject. One of theſe is by counſellor Puchberg, another by Mr. St. Julian, chaplain to the charity ſchools,

and

and another by Adam Von Heidfeld *. Stevin's work before mentioned ſhews clearly that this improvement is not new; and ſeems to leſſen what is ſaid, in a work publiſhed in 1777 †, that count Zinzendorf was the author or patron of that excellent invention, the application of the Italian method of book-keeping by double-entry to finances and public economy.

ODOMETER.

AN Odometer, Pedometer, or Waywyſer, is an inſtrument or machine, by which the ſteps of a perſon who walks, or the revolutions made by the wheel of a carriage, can be counted; and by which the diſtance that one has travelled can be aſcertained. Vitruvius, in his tenth book ‡, deſcribes a machine of this kind for a carriage, and which, in his opinion, would anſwer for a ſhip.

* A ſhort account of this improvement, and the writings it gave riſe to, may be found in *Klipſtein, Grundſaſſe der wiſſenſchaft rechnungen einzurichten.* Leipzig 1778. 8vo. and alſo in another work, by the ſame author, entitled *Grundſaſſe der rechnungswiſſenſchaft auf das privatermogen angewendet.* Wien 1774. fol.

† Denkwurdigkeiten von Wien 1777. 8vo. p. 210.

‡ C. 14. Nicolai, in the firſt part of his Travels, has tranſlated this deſcription of an odometer, and illuſtrated it with a figure by H. Catel. Explanations of the above-mentioned paſſage of Vitruvius, which throw little light on the ſubject, may be found in various editions of that author, ſuch as that by Gualterus H. Rivius Medic. et Mathem. Baſiliæ 1575. fol.

We

We are told by Capitolinus, in the Life of the emperor Pertinax, that among the effects ſold of the emperor Commodus there were carriages of various kinds, ſome of which "meaſured the "road, and pointed out the hours *;" but whether by theſe words we are to underſtand an odometer, cannot with certainty be determined.

That this inſtrument was known even in the fifteenth century, can be proved from the carving on the ducal palace at Urbino—an edifice erected in an uncommon ſtyle of magnificence, by duke Frederic, who died in 1482. The ornaments here employed form, almoſt, a complete repreſentation of all the warlike apparatus uſed at that period, both by ſea and land; and among theſe is the figure of a ſhip, which ſeems to be furniſhed with an odometer; but whether the wheels and ſprings, carved out apart, be intended to ſhew the conſtruction of it, I will not venture to decide †.

The celebrated John Fernel, phyſician to Catherine of Medicis queen of France, meaſured with an inſtrument of this kind, in 1550, a degree of the meridian between Paris and Amiens, and found it to be 68096 geometrical paces, or about

* Vehicula arte fabricæ nova, perplexis diverſiſque rotarum orbibus et exquiſitis ſedilibus, nunc ad ſolem dechinandum, nunc ad ſpiritus opportunitatem per vertiginem; *et alia iter metientia, horaſque monſtrantia.*

† This palace, with its ornaments, is deſcribed in the following expenſive work, *Memorie concernenti la citta di Urbino.* In Roma 1724. fol. The figure to which I allude is in plate 53. Bernardino Baldi, the author of the deſcriptive part, conſiders it as an odometer.

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56747 toiſes; that is, 303 toiſes leſs than Picard found it to be; or about 300 toiſes leſs than later meaſurements have made it. Picard himſelf, in his mathematical meaſurement, aſſiſted by the neweſt improvements, erred 123 toiſes. It is, therefore, very ſurpriſing that Fernel ſhould approach ſo near the truth with ſuch an inſtrument. The manner of conſtructing it however, as far as I know, appears to be loſt *.

In Levin Hulſius' treatiſe of mechanical inſtruments, publiſhed at Francfort in 1604, that author deſcribes an odometer, without naming the inventor. It appears, however, that it was the production of Paul Pfinzing, born at Nuremberg in 1554 †; and who, beſides other works, publiſhed, in 1598, *Methodus geometrica*, or a Treatiſe on meaſuring land, and how to uſe proper inſtruments for that purpoſe, on foot, on horſe-

* *In Joannis Fernelii Ambianatis Coſmotheoria*, Pariſiis 1528, we find only the following paſſage reſpecting this invention—Nec vulgi ſupputatione ſatiatus, vehiculum, quod Pariſios recta via petebat, conſcendi, in eoque reſidens tota via 17024 fere rotæ circumvolutiones collegi, vallibus et montibus ad equalitatem, quoad facultas noſtra ferebat, redactis. Erat autem rotæ diameter—In *Almageſti novi parte poſteriori*, tomi primi, Bononiæ 1651, fol. the author, Ricciolus, ſays, that Fernel contrived his carriage in ſuch a manner, that the revolutions of the wheels were ſhewn by a hammer ſtriking on a bell. "Preparato vero jam curru cum rota quadam, cujus revolutiones ſingulæ ſingulis tympani ictibus numerati, iter Pariſiis rectum verſus Boream docerent, pervenit." Where that jeſuit diſcovered this, I cannot learn.

† Doppelmayr, Nachricht von Nurnberg. kunſtlern, p. 82. Will, Nurnbergiſches Gelehrten-Lexicon, iii. p. 156.

back,

back, or in a carriage. This treatiſe, which was never ſold, but given away by the author, contains a deſcription of the ſame inſtrument deſcribed by Hulſius, and which, as Nicolai ſays, is ſtill preſerved in the collection of curioſities at Dreſden.

In the ſame collection is an odometer which Auguſtus, elector of Saxony, who reigned between the years 1553 and 1586, employed in meaſuring his territories. This inſtrument is mentioned by Beutel *, without naming the inventor; but I think it very probable that it was made by Martin Feyhel, who was born at Naumburg, and reſided at Augſburg; as Von Stetten † relates, in his Hiſtory of the arts at Augſburg, that Feyhel made a waywyſer (probably odometer) for the elector of Saxony, and that he himſelf called it a new inſtrument never before heard of. This artiſt was an intimate friend of the celebrated Chriſtopher Schiſsler, alſo of Augſburg, who in 1579 conſtructed a quadrant, ſtill to be found at Oxford; and in 1606 an armillary ſphere, ſtill preſerved at Augſburg.

The emperor Rudolphus II, who reigned from 1576 to 1612, and who was fond of, and acquainted with, the mechanical arts, poſſeſſed two very curious odometers, which not only pointed out diſtances, but alſo marked them down on paper by the way. The deſcription and uſe of one

* Cimelio geographico tripartito. Dreſden 1680. 4to. p. 124.

† Kunſtgeſchichte von Augſburg, p. 167.

of

of theſe is given by De Boot *, who was that prince's librarian; and what he ſays has been copied by Kircher †, and illuſtrated with a coarſe figure. It is not improbable that the before-mentioned Schiſsler was the maker of this inſtrument; as we are informed by Stetten that he conſtructed a great many machines and automata for the emperor Rudolphus II. The other odometer, which was much more curious, appears to have been conſtructed by that emperor himſelf ‡.

About the end of the laſt century an artiſt, in England, named Butterfield, invented an odometer which met with great approbation. In the firſt volume of the Philoſophical Tranſactions there are two papers written by this ingenious man; but of his odometer I have not yet been able to find a deſcription.

In the beginning of the preſent century, Adam Frederick Zurner, to whom we are indebted for

* Gemmarum et lapidum hiſtoria. Lugd. Bat. 1647. 8vo. p. 468.

† Magnes, ſive De arte magnetica. Coloniæ 1643. 4to. p. 221.

‡ Aliud inſtrumentum, iſto elegantius et commodius, ab imperatore Rudolpho II. domino meo glorioſiſſimo et invictiſſimo inventum eſt. Nam id tranſlatione nulla opus habet, quia mappam ipſam in plano chartaceo, aſpiciente eo qui iter pedes facit, deſcribit. In ſuperiore enim ſui parte vitrum eſt, ſub quo tota mappa ſolitariis punctis notatur, quæ non ab acu magnetica perforantur, ſed ab orbiculo ſub charta latitante, quem cum alio illi adjuncto agitat in hanc vel illam partem magnes. Id inſtrumentum, quia difficillimum eſt, a me nunc non deſcribetur; nam reſervatur pro volumine et theatro inſtrumentorum mechanicorum. *Boot. Hiſt. gemmarum*, p. 473. The intended work, here mentioned, has not, as far as I know, been ever printed.

good

good maps of the electorate of Saxony, invented alſo an odometer, or geometrical carriage, a deſcription and figure of which, taken from Schramm's *Saxonia monumentis viarum illuſtrata* *, is given by Nicolai. This inſtrument is not now to be found in the Dreſden collection.

In Bion's Treatiſe on the conſtruction of mathematical inſtruments, improved by Doppelmayr, there is a deſcription of a pedometer, and the author praiſes a new invention by one Sauveur †.

In the year 1744 Meynier laid before the Royal academy of ſciences at Paris an odometer, a ſhort account of which, without a figure, is given in the hiſtory of the academy for that year. This machine was afterwards improved by Outhier; and a deſcription of the improvements, but without any figure, is to be found in the hiſtory of the academy for 1742. A full deſcription, together with a figure, may, however, be ſeen in a work entitled, The machines and inventions approved by the academy ‡.

The neweſt and perhaps the moſt perfect machine of this kind is that made at Berlin, by an artiſt named Hohlfeld, a ſhort account of which may be found in the ninth volume of the Ham-

* Vitembergæ 1726. 4to.

† Bions Mathematiſche werkſchule, vermehrt von Doppelmayr. Nurnberg 1741—4. i. p. 99.

‡ Machines et inventions approuvées par l'academie, tome vii. Paris 1777. 4to. p. 175.

burgh

burgh Magazine. A complete deſcription I have not ſeen; but I learn from profeſſor Bernoulli's Tour through Brandenburg, Pomerania, &c. that a model of it is preſerved in the excellent collection of count de Podewils, at Guſow *. The inventor of it was a man of ſuch rare talents, and of ſuch benefit to the public, that the following anecdotes of his life may prove not unacceptable to many readers. It was written by profeſſor Muller at Berlin, and tranſmitted to me by Dr. Bloch.

Hohlfeld was born of poor parents, at Hennerndorf, in the mountains of Saxony, in 1711. He learned the trade of lace-making at Dreſden, and early diſcovered a turn for mechanics by conſtructing various kinds of clocks. From Dreſden he removed to Berlin to follow his occupation. As he was an excellent workman, and invented ſeveral machines for ſhortening his labour, he found ſufficient time to indulge his inclination for mechanics; and he made there, at the ſame time that he purſued his uſual buſineſs, air-guns and clocks.

In the year 1748 he became acquainted with

* This machine was uſed by Sulzer during his tour. See his Journal, publiſhed at Leipſic 1780, 8vo. p. 3. It has been ſince improved by Schumacher, a clergyman at Elbing. *Neueſte Mannigfaltigkeiten*, 1774, p. 1. The lateſt improvements are by Klindworth, Catel at Berlin, and by an anonymous clergyman in *Schwabiſchen Magazin*, 1777, p. 306. See *Gottingiſches Taſchenbuch*, 1778, p. 76, and *Nicolai Reiſe* in the Appendix, p. 18.

the

the celebrated Sulzer, at whoſe deſire he undertook the conſtruction of a machine for noting down any piece of muſic when played on a harpſichord. A machine of this kind had been before invented by Mr. Von Unger; but Hohlfeld, from a very imperfect deſcription, completed one without any other aſſiſtance than that of his own genius. Of this machine, now in poſſeſſion of the Academy of ſciences at Berlin, Sulzer gave a figure, from which it was afterwards conſtructed in England. This ingenious piece of mechaniſm was univerſally approved, though ſeveral things may be wanting to render it complete; but no one was ſo generous as to indemnify the artiſt for his expences, or to reward him for his labour.

About the year 1756, the Pruſſian miniſter, count de Podewils, took him into his ſervice, chiefly for the purpoſe of conſtructing waterworks in his magnificent gardens at Guſow. There he invented his well-known threſhing-mill, and another for chopping ſtraw more expeditiouſly. He alſo diſplayed his talent for invention, by conſtructing a machine, which, being faſtened to a carriage, indicates the revolutions made by the wheels. Such machines had been made before, but his far exceeded every thing of the like kind. Having loſt this machine by a fire, he invented another, ſtill ſimpler, which was ſo contrived as to be buckled between the ſpokes of the wheel. This piece of mechaniſm was in the poſſeſſion of Sul-

zer, who uſed it on his tour, and found that it anſwered the intended purpoſe.

In the year 1765, when the preſent duke of Courland, then hereditary prince, reſided at Berlin, he paid a viſit to Hohlfeld, and endeavoured to prevail on him to go to Courland, by offering him a penſion of 800 rix-dollars; but this ingenious man was ſo contented with his condition, and ſo attached to his friends, that he would not, merely for ſelf-intereſt, quit Berlin. His refuſal, however, obtained for him a penſion of 150 dollars from the king.

Beſides the before-mentioned machines, he conſtructed, occaſionally, ſeveral uſeful models. Among theſe were a loom for weaving figured ſtuffs, ſo contrived that the weaver had no need for any thing to ſhoot through the woof *; a pedometer for putting in the pocket; a convenient and ſimple bed for a ſick perſon, which was of ſuch a nature that the patient, with the ſmalleſt ſtrength, could at any time raiſe or lower the breaſt, and when neceſſary convert the bed into a ſtool; and a carriage ſo formed, that if the horſes took fright, or ran away, the perſon in it could, by a ſingle puſh, looſen the pole, and ſet them at liberty. The two laſt models have been loſt.

Every machine that this ſingular man ſaw, he altered and improved in the ſimpleſt manner. All

* This model is preſerved in the collection of the Academy.

his own inſtruments he made himſelf, and repaired them when damaged. But as he was fonder of inventing than of following the plans of others, he made them in ſuch a manner that no one except himſelf could uſe them. Several of his improvements were, however, imitated by common workmen, though in a very clumſy manner. It is worthy of remark, that he never beſtowed ſtudy upon any thing; but when he had once conceived an idea, he immediately executed it. He comprehended, in a moment, whatever was propoſed; and, at the ſame time, ſaw how it was to be accompliſhed. He could, therefore, tell in an inſtant whether a thing was practicable: if he thought it was not, no perſuaſion or offer of money could induce him to attempt it. He never purſued chimæras, like thoſe mechanics who have not had the benefit of education or inſtruction; and though this may be aſcribed to the intercourſe he had with great mathematicians and philoſophers, there is every reaſon to believe, that he would have equally guarded againſt them, even if he had not enjoyed that advantage. The ſame quickneſs of apprehenſion which he manifeſted in mechanics he ſhewed alſo in other things. His obſervations on moſt ſubjects were judicious, and peculiar to himſelf; ſo that it may be ſaid, without exaggeration, that he was born with a philoſophical mind.

With regard to his moral character, he was very different from thoſe of the ſame claſs. Though

he ſtill retained ſomething of the manners of his former condition, his mild and civil deportment rendered his company and converſation agreeable. He poſſeſſed a good heart, and his life was ſober and regular. Though he was every day welcome at the beſt tables, he ſtaid for the moſt part at home, through choice; went to market for his own proviſions, which he cooked himſelf; and was as contented over his humble meal as Curius was over his turnips.

A little before his death, he had the pleaſure of ſeeing a curious harpſichord he had made, and which was purchaſed by his Pruſſian majeſty, placed in an elegant apartment in the new palace at Potſdam. As he had for ſome time neglected this inſtrument, the too great attention which he beſtowed on putting it in order contributed not a little to bring on that diſeaſe which at laſt proved fatal to him. His clock having become deranged during his illneſs, he could not be prevented, notwithſtanding the admonition of his friend and phyſician Dr. Stahls, from repairing it. Cloſe application occaſioned ſome obſtructions which were not obſerved till too late; and, an inflammation taking place, he died, in the year 1771, at the houſe of count de Podewils, in the 60th year of his age.

MACHINE FOR NOTING DOWN MUSIC.

AS I have occaſionally mentioned in the preceding article, a machine for noting down any piece of muſic played on a harpſichord or other muſical inſtrument, I ſhall here add a ſhort hiſtory of the invention of it, as far as I know, and with the greater pleaſure, as another nation has laid claim to it, though it belongs to my countrymen.

It appears inconteſtable, that a propoſal for inventing ſuch a machine was firſt made known by an Engliſhman. In the month of March 1747, John Freke tranſmitted to the Royal Society a paper written by a clergyman of the name of Creed, which was printed in the Philoſophical Tranſactions under the following title: "A Demonſtration of the poſſibility of making a machine that ſhall write extempore voluntaries, or other pieces of muſic, as faſt as any maſter ſhall be able to play them upon an organ, harpſichord, &c. and that in a character more natural and more intelligible, and more expreſſive of all the varieties thoſe inſtruments are capable of exhibiting, than the character now in uſe *." The author of this paper, however, points out the

* See Philoſ. Tranſact. vol. xliv. p. ii. p. 483. p. 446. Alſo Martin's Abridgement, vol. x. p. 226.

poſſibility

poſſibility only of making ſuch a machine, without giving directions how to conſtruct it.

In the year 1745, John Frederic Unger, then land-bailiff and burgomaſter of Einbec, and who is known by ſeveral learned works, fell upon the ſame invention without the ſmalleſt knowledge of the idea publiſhed in England. This invention, however, owing to the variety of his occupations, he did not make known till the year 1752, when he tranſmitted a ſhort account of it, accompanied with figures, to the Academy of Sciences at Berlin. The Academy highly approved of it, and it was ſoon celebrated in ſeveral gazettes, but a deſcription of it was never printed.

A few days after Euler had read this paper of Mr. Unger's before the Academy, Mr. Sulzer informed Hohlfeld of the invention, and adviſed him to exert his ingenuity in conſtructing ſuch a machine. In two weeks, this untaught mechanic, without having read Mr. Unger's paper, and even without inſpecting the figures, completed the machine, which Mr. Unger himſelf had not been able to execute through want of an artiſt capable of following his ideas.

Unger's own deſcription of his invention was printed, with copper plates, at Brunſwick, in the year 1774, together with the correſpondence between him and Euler, and other documents. A deſcription of Hohlfeld's machine, illuſtrated with figures, was publiſhed after his death, by Mr.

Sulzer, in the new Memoirs of the Academy of Berlin *, under the title of " Deſcription of a ma-" chine for noting down pieces of muſic as faſt as " they are played upon the harpſichord." Sulzer there remarks, that Hohlfeld had not followed the plan ſketched out by Mr. Unger, and that the two machines differed in this—that Unger's formed one piece with the harpſichord, while that of Hohlfeld could be applied to any harpſichord whatever.

When Dr. Burney viſited Berlin, he was made acquainted with Hohlfeld's machine by Mr. Marpurg; and has been ſo ungenerous, or rather unjuſt, as to ſay in his Muſical Travels, that it is an Engliſh invention, and that it had been before fully deſcribed in the Philoſophical Tranſactions. This falſehood Mr. Unger has ſufficiently refuted. Without repeating his proofs, I ſhall here content myſelf with quoting his own words, in the following paſſage: " How can Burney wiſh to deprive " our ingenious Hohlfeld of the honour of being " the ſole author of that invention, and to make " an Engliſhman ſhare it with him, becauſe our " German happened to execute ſucceſsfully what " his countryman Creed only ſuggeſted? Such " an attempt is as unjuſt in its conſequences, as it " is diſhonourable to the Engliſh nation and the " Engliſh artiſts. When we reflect on the high

* See Nouveaux Mémoires de l'Académie à Berlin, année 1771, p. 538.

" eſtimation

" eſtimation in which muſic is held in England ;
" the liberality of the Engliſh nobility, and their
" readineſs to ſpare no expences in bringing for-
" ward any uſeful invention, a property peculiar
" to the Engliſh; it affords juſt matter of ſurpriſe,
" that the Engliſh artiſts ſhould have ſuffered
" themſelves to be anticipated by a German
" journeyman lace-maker. To our Hohlfeld,
" therefore, will inconteſtably remain the laſting
" honour of having executed a German invention ;
" and the Germans may contentedly wait to ſee
" whether Burney will find an Engliſh mechanic
" capable of conſtructing this machine, from the
" information given by his countryman Creed."

REFINING GOLD AND SILVER ORE BY QUICKSILVER.

AMALGAMATION.

IT is well known that quickſilver unites very readily with almoſt all metals, and when added in a conſiderable quantity forms with them a paſte which can be kneaded, and which is called amalgama. On the other hand, as it does not ſuffer itſelf to unite with earth, being a metallic ſubſtance ; it furniſhes an excellent medium for ſeparating gold and ſilver from the earth and ſtones in which they are found. The amalgama is ſqueezed through a piece of leather, in which theſe precious metals re-

main with a certain portion of the quickſilver, and the former are freed from the latter by means of fire, which cauſes the ſemi-metal to evaporate. This amalgama made with gold ſerves alſo for gilding metals, if it be rubbed over them, and afterwards heated till the quickſilver be diſperſed by evaporation.

The firſt uſe of quickſilver is commonly reckoned a Spaniſh invention, diſcovered about the middle of the ſixteenth century; but it appears from Pliny, that the ancients were acquainted with amalgama, and its uſe, not only for ſeparating gold and ſilver from earthy particles, but alſo for gilding *. Vitruvius deſcribes the manner of recovering gold from cloth in which it has been interwoven. The cloth, he ſays, is to be put in an earthen veſſel, and placed over the fire, in order that it may be burnt. The aſhes are to be thrown into water, and quickſilver added to them. The latter attracts the particles of the gold, and makes them unite with it. The water is then to be poured off, and the reſidue put into a piece of cloth; which being ſqueezed with the hands, the quickſilver, on account of its fluidity, oozes through the pores, and the gold is

* Argentum vivum exeſt ac perrumpit vaſa, permanans tabe dira—Optime purgat aurum, cæteras ejus ſordes exſpuens crebro jactatu fictilibus in vaſis.—Sed ut ipſum ab auro diſcedat, in pelles ſubactas effunditur, per quas ſudoris vice defluens, purum relinquit aurum. Ergo et cum æra inaurantur, ſublitum bracteis pertinaciſſime retinet. Vol. ii. p. 622. edit. Hard. or book xxxiii. chap. 6.

left

left pure in a compreſſed maſs *. Iſidore of Seville ſays alſo, that quickſilver is beſt preſerved in veſſels of glaſs, as it penetrates all other ſubſtances, and that without it neither ſilver nor braſs can be gilded †. Modern mineralogiſts, however, have this advantage over the ancient, that they know how to ſeparate the quickſilver from gold and ſilver without loſing it. Inſtead of applying the amalgama to an open fire, as formerly, and cauſing the ſemi-metal to evaporate, it is now put into a retort, and the quickſilver is collected in a recipient for further uſe.

Thoſe alſo who waſh gold from the ſand found near rivers, uſe quickſilver before their work is completed; and I am ſtrongly inclined to believe, that this method prevailed in Germany long before the diſcovery of the mines in America. In the year 1582, John Michael Heberer deſcribed the waſhing of gold as he ſaw it practiſed at Selz, not far from Straſburgh; and at that time quickſilver had been long employed for that purpoſe ‡. In Treitlinger's Diſſertation, alſo, concerning the collecting of gold, and particularly in the Rhine, there is a deſcription of the manner in which gold ſand is waſhed by means of quickſilver, but no date is mentioned §.

* Vit. lib. vii. c. 8. † In Origin. lib. xvi. c. 18.

‡ See Pfalziſchen Robinſons and Kreuzbruders Heberers Reiſen. Frankf. und Leipzig 1747, 8vo. p. 46.

§ T. L. Treitlinger's Diſſertation, de Aurilegio, præcipue in Rheno, p. 60. Argentorati 1776.

The

The hiſtory of employing mercury in procuring the American ſilver is, as far as I know, moſt fully given by the jeſuit Acoſta*, whoſe Relation of the Indies abounds with curious and uſeful information. The quickſilver mines of Peru are ſituated in an extenſive ridge of mountains near Guamanga, on the ſouth ſide of Lima, and at no great diſtance from it. They are called Guancabelica, or Guancavilia. The mines were diſcovered about the year 1566 or 1567, when Caſtro was viceroy of Peru, by Henry Garces, or Graces†, as he is called by the Portugueſe. This man was a native of Porto, went to Peru in the Spaniſh ſervice, and after the death of his wife became canon of the cathedral of Mexico. He tranſlated the Luſiad of Camoens from the Portugueſe into Spaniſh, and this has procured him a place in profeſſor Dieze's tranſlation of Velaſquez's Hiſtory of Spaniſh poetry‡. He cauſed a law to be enacted that no ſilver bullion ſhould be ſuffered to circulate in Peru; but his greateſt ſervice was the diſcovery of the quick-

* Hiſtoria naturale e morale delle Indie—novamente tradotta della lingua Spagnuola nella Italiana da Gio. Paolo Galucci Salodiano. In Venetia 1596, 4to. p. 70. or Hiſtoire naturelle et morale des Indes—traduite en François par Robet Regnault Cauxois. A Paris 1600, 8vo. p. 151.

† Some account of Garces may be found in Bibliotheca Luſitana, na qual ſe comprehende a noticia dos authores Portuguezes—por Diego Barboſa Machado. Liſboa 1747, fol. t. ii. p. 448.

‡ See Dieze, Ueberſetſung von Velaſques Geſchichte der Spaniſchen dichtkunſt. Gottingen 1769, 8vo. p. 481.

ſilver

ſilver mines. As he was one day examining the red earth, which the Indians uſe for paint, and call *limpi*, he obſerved that it was native cinnabar; and as he knew that quickſilver was extracted from it in Europe, he went to the place where it was dug up, made ſome experiments, and thus laid a foundation for the moſt important works. No one, however, thought of employing this ſemi-metal in the ſilver mines, till the year 1571, when, Francis de Toledo being viceroy, one Pero Fernandes de Velaſco, came to Peru, and offered to refine the ſilver by mercury, as he had learned at the ſmelting-houſes in Mexico. His propoſal being accepted, and his attempts proving ſucceſsful, the old methods were abandoned, and that of amalgamating purſued as it is practiſed at preſent *. From this account it appears that Garces was not the inventor of amalgamation; that it was introduced firſt into Peru in the year 1571, and that it had been long before practiſed in Mexico: but at what period it was uſed there I have not been able to learn. The abbé Raynal ſays, that quickſilver was a free article of trade till the year 1571, when it was declared to belong excluſively to the crown; and this regulation was in conſequence of its being

* The ſame account as that given by Acoſta may be ſeen in Garcilaſſo de la Vega, primera parte de los Commentarios reales—En Liſboa 1609, folio, p. 225—in Rycaut's Engliſh tranſlation, London 1688, fol. i. p. 347—and in John de Laet, Novus orbis, Lugd. Bat. 1633, fol. p. 447.

employed

employed in refining. Robertſon, in his Hiſtory of America, tells us that the mines of Guanacabelica were diſcovered in 1563, and that amalgamation was introduced in 1574.

Anderſon ſays, in his Hiſtory of commerce*, that in the ſecond volume of Hakluyt there is a letter which ſhews the uſe of quickſilver to have been a new invention in the year 1572. This letter I found, not in the ſecond but in the third and laſt volume of the Voyages collected by Hakluyt †. It was written in the above year, by a merchant named Henry Hawks, and contains only the following information: "A good owner of "mines muſt have much quickſilver; and as for "this charge of quickſilver, it is a new invention "which they find more profitable than to fine their "ore with lead."

Gobet, in a work intitled The ancient mineralogiſts of France, accuſes Alphonſo Barba of aſſerting that he found out amalgamation in the year 1609. To examine this charge, it will be neceſſary to give ſome account of the metallurgic works of that Spaniard, which, perhaps, may not prove unacceptable to thoſe who are fond of metallurgy and mineralogy. Alvaro Alphonſo Barba was born at Lepe, a ſmall town in Andaluſia, and officiated

* Vol. i. p. 414.

† Hakluyt's Collection of Voyages. London 1600, fol. vol. iii. p. 466.

many

many years as clergyman of the church of St. Bernard at Potoſi *. The firſt edition of his work was printed in quarto, at Madrid, in 1640, in the Spaniſh language, and illuſtrated with cuts †. This book the Spaniards for a long time concealed, becauſe they conſidered it as containing all their metallurgic ſecrets, though at that time there were much better works of the kind in Germany, and though amalgamation had been long known and practiſed. Edward earl of Sandwich, being ambaſſador to Spain, found, however, an opportunity of procuring a copy of it, as a great rarity; and he began a tranſlation of it into Engliſh, but tranſlated only the two firſt books. This tranſlation was publiſhed at London in octavo, in 1674, after the earl's death, and entitled *The firſt book of the art of metals, in which is declared the manner of their generation, and the concomitants of them. Written in Spaniſh by Albar Alonſo Barba, tranſlated by the earl of Sandwich.* From this Engliſh edition ſeveral German tranſlations have been made, of which I am acquainted with the following: two at Hamburgh, one printed in 1676, and the other in 1696; and two at Francfort, one in 1726, and another in 1739. In the year 1749 a new edition

* See Antonii Bibliotheca Hiſpana nova. Romæ 1672, fol. t. i. p. 45.

† El arte de los metallos, en que ſe enſeña el verdadero beneficio de los de oro y plata por azogue, y el modo de fundir los todos, y como ſe an de refinar, y apartar unos de otros. Madrid 1640.

appeared

appeared at Vienna. This edition, which is very different from any of the former, was tranſlated from the French by one Godar, who was not a German, and who on that account apologiſes in the preface for the badneſs of his ſtyle. All theſe editions, however, are imperfect; for the original contains five books, as we learn from Leibnitz, who cauſed them to be tranſcribed *. In the year 1751 a new tranſlation came out at Paris, entitled Metallurgy, or the art of extracting and purifying metals, tranſlated from the Spaniſh of Alphonſo Barba, by M. Gosfort, with the moſt curious diſſertations on mines and metallic operations †; of this tranſlation the celebrated abbé Lenglet de Freſnoy is ſaid to have been the editor ‡.

To judge by two of the German editions, Gobet has done Barba an injuſtice. In that of 1676, I find Barba expreſsly ſays, he does not believe the ancients were acquainted with the art of extracting ſilver from pounded ore by the means of quick-ſilver. This, certainly, does not indicate that he laid claim to the invention: beſides, he every where ſpeaks of amalgamation as an art long uſed in

* See Prodromus bibliothecæ metallicæ. Wolfenbuttle 1732, 8vo p. 20.

† Metallurgie, ou l'Art de tirer et purifier les metaux. Traduite de l'Eſpagnol d'Alphonſe Barba, par M. Gosfort; avec les diſſertations les plus rares ſur les mines et les operations metalliques. Paris 1751, 12mo. 2 tom.

‡ La France littéraire. Paris 1769, 2 vol. 8vo. v. ii. p. 410.

America,

America, but complains of the negligence with which it was practiſed. In a paſſage, however, in the Vienna edition, and which hath probably been added by Gobet, we are told that, in the year 1609, Barba attempted to fix quickſilver, and with that view bethought himſelf of mixing it with fine pounded ſilver ore; that he at firſt imagined, with ſurpriſe, that he had obtained a maſs of ſilver, but that he ſoon perceived that the mercury was not changed into ſilver, but had only attracted the particles of that metal. "I was," adds Barba, "highly pleaſed with my new diſcovery of ma-"naging ore, of extracting its contents, and of "refining it; and this method I continued to prac-"tiſe."—I imagine that Barba was ſtill in Europe in 1609, and made that experiment before he was acquainted with the ſmelting-works in America. I am, however, of opinion, that one will ſee by the original, that Barba did not wiſh to claim the invention of amalgamation as practiſed in the mines of America.

DRY GILDING.

DRY gilding, as it is called by ſome workmen, is a light method of gilding, by ſteeping linen rags in a ſolution of gold, then burning them; and, with a piece of cloth dipped in ſalt-water, rubbing the

the aſhes over ſilver intended to be gilt. This method requires neither much labour, nor much gold, and may be employed with advantage for carved work and ornaments. It is however not durable.

I am of opinion, that this manner of gilding is a German invention, and that foreigners, at leaſt the Engliſh, were firſt made acquainted with it about the end of the laſt century; for Robert Southwell deſcribes it in the Philoſophical Tranſactions for the year 1698, and ſays, that it was known to very few goldſmiths in Germany.

GOLD VARNISH.

AS mankind could not have every thing that they wiſhed for of gold, they were contented with incruſting many articles with this precious metal. For that purpoſe the gold was beat into plates, with which the walls of apartments, diſhes, and other veſſels were covered. In early ages, theſe plates were thick, ſo that gilding in this manner was very expenſive *; but in proceſs of time the expence was much leſſened, becauſe the art was diſcovered of making theſe gold plates thinner, and of laying them on with a ſize. Articles, however,

* One may ſee in Homer's Odyſſey, book iii. v. 432. the proceſs employed for gilding, in this manner, the horns of the cow brought by Neſtor as an offering to Minerva

ornamented

ornamented in this manner were ſtill coſtly, and the valuable metal was always loſt. Yellow golden colours of all kinds were then tried; but theſe did not fully produce the required effect, as they wanted that ſplendour peculiar to metals, and appeared always languid and dull. It was not till modern times that artiſts bethought themſelves of overlaying with ſilver, or ſome cheaper white metal, thoſe things which they wiſhed to have the appearance of gold, and then daubing them over with a yellow tranſparent varniſh, in order to give to the white metal the colour of gold, and to the colour the ſplendour of metal. "When we cover "our houſes with gold," ſays Seneca, "what elſe "do we do than rejoice in deception? for we know "that coarſe wood is concealed under that gold*."

This ingenious proceſs, which at preſent is employed all over Europe in gilding wooden frames, coaches, and various articles, and which was formerly uſed in the preparation of the now old-faſhioned leather tapeſtry, was invented towards the end of the laſt century. Anderſon, in his Hiſtorical and chronological deduction of the origin of commerce, ſays, that it was introduced into England by one Evelyn in the year 1633; and quotes, in ſupport of this aſſertion, The preſent State of England, printed in 1683.

This invention, however, does not belong to

* Cum auro tecta perfundimus, quid aliud quam mendacio gaudemus? Scimus enim ſub illo auro fœda ligna latitare. Epiſt. 115.

the Engliſh, but to the Italians, and properly to the Sicilians. Antonino Cento, an artiſt of Palermo, found out the gold varniſh, and in the year 1680 publiſhed there an account of the method of preparing it. That work I have never ſeen; but this information I found in a book, printed at Palermo in 1704, and entitled The Inventions of the Sicilians *. Among the few important things contained in this book, the greater part of which is compiled from old Latin writers, there is, in the additions, a receipt how to prepare the gold varniſh (*vernice d'oro*). The whole account I ſhall tranſcribe, as the authors of the French Journal of agriculture, commerce, and the arts thought it worth their trouble to make it known in that work in 1778.

" Take gum lac, and having freed it from the filth and bits of wood with which it is mixed, put it into a ſmall linen bag, and waſh it, in pure water, till the water no longer becomes red; then take it from the bag and ſuffer it to dry. When it is perfectly dry, pound it very fine; becauſe the finer it is pounded it will diſſolve the more readily. Then take four parts of ſpirits of wine, and one of the gum, reduced, as before directed, to an impalpable powder, ſo that for every four pounds of

* La Sicilia inventrice; overo, Le invenzione lodevoli nate in Sicilia, opera del Dottor. D. Vincenzo Auria, Palermitano: con li divertimenti geniali, oſſervazioni e guinte all' iſteſſa, di D. Antonio Mongitore, ſacerdote Palermitano. In Palermo 1704. 300 pages in quarto.

ſpirits you may have one of gum: mix theſe together, and, having put them into an alembic, graduate the fire ſo that the gum may diſſolve in the ſpirits. When diſſolved, ſtrain the whole through a ſtrong piece of linen cloth; throw away what remains in the cloth, as of no uſe, and preſerve the liquor in a glaſs bottle cloſely corked. This is the gold varniſh, which may be employed for gilding any kind of wood.

" When you wiſh to uſe it, you muſt, in order that the work may be done with more ſmoothneſs, employ a bruſh made of the tail of a certain quadruped called the vari, well known to thoſe who ſell colours for painting, and with this inſtrument dipped in the liquor waſh over gently, three times, the wood which has been ſilvered. You muſt, however, remember every time you paſs the bruſh over the wood to let it dry; and thus your work will be extremely beautiful, and have a reſemblance to the fineſt gold."

After this invention was made known, it was not difficult to vary, by ſeveral methods, the manner of preparing it. Different receipts, therefore, have for that purpoſe been given in a number of books, ſuch as Croker's Painter, and others: and, on this account, young artiſts are frequently at a loſs which to chooſe; and when a receipt is found better than another, experienced artiſts keep it always ſecret.

With the preparation of that varniſh uſed for

gilding leather tapeſtry Reaumur was acquainted, and from his papers it was made known by Fougeroux de Bondaroy. The method of making the Engliſh varniſh was communicated by Scarlet to Hellot, in the year 1720; and by Graham to Du Fay, in 1738. In the year 1761, Hellot gave the receipt to the Academy of Sciences at Paris, who publiſhed it in their memoirs for that year.

If it be true, as Fougeroux ſays, that gilded tapeſtry was made above two hundred years ago, it might be worth the little trouble that ſuch an examination would require to inveſtigate the method uſed to gild it. Nothing would be neceſſary but to rub a piece over with rectified ſpirits of wine, which would diſſolve the varniſh, and diſcover the metal.

TULIPS.

THE greater part of the flowers which adorn our gardens have been brought to us from the Levant. A few have been procured from other parts of the world; and ſome of our own indigenous plants, that grow wild, have, by care and cultivation, been ſo much improved as to merit a place in our parterres. Our anceſtors, perhaps, ſome centuries ago paid attention to flowers; but it appears that the Orientals, and particularly the Turks,

Turks, who in other reſpects are not very ſuſceptible of the inanimate beauties of nature, were the firſt people who cultivated a variety of them in their gardens for ornament and pleaſure. From their gardens, therefore, have been procured the moſt of thoſe which decorate ours; and amongſt theſe is the tulip.

Few plants acquire through accident, weakneſs, or diſeaſe, ſo many tints, variegations, and figures as the tulip. When uncultivated, and in its natural ſtate, it is almoſt of one colour; has large leaves and an extraordinary long ſtem. When it has been weakened by culture, it becomes more agreeable in the eyes of the floriſt. The petals are then paler, more variegated, and ſmaller; the leaves aſſume a fainter or ſofter green colour: and this maſterpiece of culture the more beautiful it turns grows ſo much the weaker, ſo that, with the moſt careful ſkill and attention, it can ſcarcely be tranſplanted, and even ſcarcely kept alive.

That the tulip grows wild in the Levant, and was thence brought to us, may be proved by the teſtimony of many writers. Buſbeque found them on the road between Adrianople and Conſtantinople*; Shaw

* As we paſſed, we ſaw every where abundance of flowers, ſuch as the narciſſus, hyacinth, and thoſe called by the Turks tulipan, not without great aſtoniſhment, on account of the time of the year, as it was then the middle of winter, a ſeaſon unfriendly to flowers. Greece abounds with narciſſuſes and hyacinths, which have a remarkably fragrant ſmell. It is, indeed, ſo ſtrong as to hurt thoſe who are not

Shaw found them in Syria, in the plains between Jaffa and Rama; and Chardin on the northern confines of Arabia*. The early blowing kinds, it appears, were brought to Conſtantinople from Cavala, and the late blowing from Caffa; and on this account the former are called by the Turks *Cavalá lalé*, and the latter *Caffé lalé*. Caval is a town on the eaſtern coaſt of Macedonia, of which Paul Lucas gives ſome account; and Caffa is a town in the Crimea†, or peninſula of Gazaria, as it was called, in the middle ages, from the Gazares, a people very little known‡.

Though floriſts have publiſhed numerous catalogues of the ſpecies of the tulip, botaniſts are acquainted only with two, or at moſt three, of which ſcarcely one is indigenous in Europe||. All thoſe found

accuſtomed to it. The tulipan, however, have little or no ſmell, but are admired for the beauty and variety of their colour. The Turks pay great attention to the cultivation of flowers, nor do they heſitate, though by no means extravagant, to expend ſeveral aſpers for one that is beautiful. I received ſeveral preſents of theſe flowers, which coſt me not a little. *Buſbequii omnia quæ extant.* Baſiliæ 1740. 8vo. p. 36.

* Voyages. A Rouen 1723. 8vo. iv. 59.

† Hactenus tuliparum bulbi nobis Byzantio miſſi ſunt, præcocis quidem *Café lalé*, ſerotinæ vero *Cavalá lalé*, a locis nimirum unde primum Conſtantinopolim illati ſunt, appellatione indita. Caffa urbs eſt in peninſula Gazaria dicta, quæ inter Propontidem et Euxinum pontum ſita eſt; Cavalla vero in Macedonia urbs maritima. *Cluſii rariorum plantarum hiſtoria.* Antverpiæ 1601. fol. p. 150.

‡ See ſome account of them in *Memoriæ populorum ad Danubium*, by Stritter.

|| The tulipa ſylveſtris LINN. grows in the ſouthern parts of France.

found in our gardens have been propagated from the ſpecies named after that learned man, to whom natural hiſtory is ſo much indebted, the Linneus of the ſixteenth century, Conrad Geſner, who firſt made the tulip known by a botanical deſcription and a figure. In his additions to the works of Valerius Cordus, he tells us, that he ſaw the firſt in the beginning of April 1559, at Augſburg, in the garden of the learned and ingenious counſellor John Henry Herwart *. The ſeeds had been brought from Conſtantinople, or according to others from Cappadocia. This flower was then known in Italy, under the name of tulipa, or tulip, which is ſaid to be of Turkiſh extraction, and given to it on account of its reſembling a turban †.

France. Dodoneus ſays, in his *Florum coroniarum herbarum hiſtoria*, Antverpiæ 1569. 8vo. p. 204. In Thracia et Cappadocia tulipa exit; Italiæ et Belgio peregrinus flos eſt. Minores alicubi in Gallia Narbonenſi naſci feruntur. Linnæus reckons it among the Swediſh plants, and Haller names it among thoſe of Swiſſerland, but ſays, afterwards, I do not believe it to be indigenous, though it is found here and there in the meads. *Hiſt. ſtirp.* ii. p. 115. It appears that this ſpecies is earlier than the common *tulipa geſneriana*, though propagated from it. The uſeleſs roots thrown perhaps from Geſner's garden have grown up in a wild ſtate, and become naturalized, as the European cattle have in America. See *Miller's Gardener's Dictionary*, iv. p. 518.

* Stetten, in his Hiſtory of the arts at Augſburg, celebrates Herwart's gardens and his collection of coins. See Stetten's *Kunſt-Geſchichte der Reichs-Stadt Augſburg*. Augſb. 1779. 8vo. p. 122 and 509.

† See Martini Lexicon philologicum. Trajecti Batav. 1711. 2 vol. fol. ii. p. 780. and Megiſeri Diction. Turcico-Lat. where the word *tulbent*, a turban, is derived from the Chaldaic.

Balbinus aſſerts, that Buſbeque brought the firſt tulip roots to Prague, from which they were afterwards ſpread all over Germany *. This is not improbable: for Buſbeque ſays, in a letter written in 1554, that this flower was then new to him, and it is known that beſides coins and manuſcripts he collected alſo natural curioſities, and brought with him from the Levant. Nay, he himſelf ſays that he paid very dear to the Turks for theſe tulips; but I do not find he any where ſays that he was the firſt who brought them from the eaſt.

In the year 1565 there were tulips in the garden of Mr. Fugger, from whom Geſner wiſhed to procure ſome †. They firſt appeared in Provence, in France, in the garden of the celebrated Peyreſc, in the year 1611 ‡.

After the tulip was known, Dutch merchants, and rich people at Vienna, who were fond of flowers, ſent, at different times, to Conſtantinople for various kinds. The firſt roots planted in England were ſent thither from Vienna, about the end of the ſixteenth century, according to Hakluyt ‖; who is, however, wrong in aſcribing to Cluſius

* Balbini Miſcellanea Bohemiæ, p. 100.

† Geſneri Epiſtolæ medicinales. Tiguri 1577. 8vo. p. 79 and 80.

‡ Vita Peireſcii, auctore Gaſſendo. Hagæ Comitum 1655. 4to. p. 80.

‖ Hakluyt ſays, And now within theſe four years, there have been brought into England from Vienna in Auſtria, divers kind of flowers called tulipas, and thoſe and others procured thither a little before, from Conſtantinople, by an excellent man, M. Carolus Cluſius. See *Biographia Britannica*, ii. p. 164.

the

the honour of having firſt introduced them into Europe; for that naturaliſt only collected and deſcribed all the then known ſpecies.

Theſe flowers, which are of no farther uſe than to ornament gardens, which are exceeded in beauty by many other plants, and whoſe duration is ſhort, and very precarious, became, in the middle of the laſt century, the object of a trade, ſuch as is not to be met with in the hiſtory of commerce, and by which their price roſe above that of the moſt precious metals. An account of this trade has been given by many authors; but by all late ones it has been miſrepreſented. People laugh at the Tulipomania *, becauſe they believe that the beauty and rarity of the flowers induced floriſts to give ſuch extravagant prices: they imagine that the tulips were purchaſed ſo exceſſively dear, in order to ornament gardens; but this ſuppoſition is falſe, as I ſhall ſhew hereafter.

This trade was not carried on throughout all Europe; but in ſome cities of the Netherlands, particularly Amſterdam, Harlem, Utrecht, Alkmar, Leyden, Rotterdam, Hoorn, Enkhuyſen and Meedenbliek; and roſe to the greateſt height in the years 1634, 35, 36 and 37†. Munting has

* This word was coined by Menage.

† The principal works in which an account of this Tulipomania is to be found are: *Eerſte tzamenſpraak tuſchen Waermondt en Gaargoed nopens de opkomſt en ondergang van Flora.* Amſterdam 1643. 12mo. *Meterani novi* or New Hiſtory of the Netherlands, part fourth. Amſt. 1640. folio. p. 518. from which Marquard, *De jure mercatorum*, p. 181,

has given, from ſome of the books kept during that trade, a few of the prices then paid, of which I ſhall preſent the reader with the following. For a root of that ſpecies called the Viceroy, the aftermentioned articles, valued as below expreſſed, were agreed to be delivered.

	florins
2 laſts of wheat -	448
4 ditto rye -	558
4 fat oxen -	480
8 fat ſwine -	240
12 fat ſheep -	120
2 hogſheads of wine -	70
4 tons beer -	32
2 ditto butter -	192
1000 pounds of cheeſe -	120
a complete bed -	100
a ſuit of clothes -	80
a ſilver beaker -	60
Sum	2500

p. 181, has taken his information. *Naauwkeurige beſchryving der aard-gewaſſen, door* Abraham Munting. Leyden en Utrecht 1696. folio. p. 907. *De Koophandel van Amſterdam*, door Le Long, ii. p. 307. *Le Negoce d'Amſterdam*, par J. P. Ricard. A Rouen 1723. 4to. p. 11. *Breſlauer, Samlung von Natur-und Kunſt-Geſchichten*, 1721, May, p. 521. *Franciſci Schaubuhne.* vol. ii. p. 639. *Tenzel, Monatliche Unterredungen*, 1690, Novemb. p. 1039. *Année Literaire*, 1773, xv. p. 16. *Martini Zeiler Miſcellanea*, p. 29. *Chriſt. Funcii Orbis politicus*, p. 879.

These

Theſe tulips afterwards were ſold according to the weight of the roots. Four hundred perits * of Admiral Liefken coſt 4400 florins; 446 ditto of Admiral Von der Eyk, 1620 florins; 106 perits Schilder coſt 1615 florins; 200 ditto Semper Auguſtus, 5500 florins; 410 ditto Viceroy, 3000 florins, &c. The ſpecies Semper Auguſtus has been often ſold for 2000 florins; and it once happened, that there were only two roots of it to be had, the one at Amſterdam and the other at Harlem. For a root of this ſpecies, one agreed to give 4600 florins, together with a new carriage, two grey horſes, and a complete harneſs. Another agreed to give twelve acres of land for a root: for thoſe who had not ready money, promiſed their moveable and unmoveable goods, houſe and lands, cattle and clothes. A man, whoſe name Munting once knew, but could not recollect, won by this trade more than 60,000 florins in the courſe of four months. It was followed not only by mercantile people, but alſo by the firſt noblemen, citizens of every deſcription, mechanics, ſeamen, farmers, turf-diggers, chimney-ſweeps, footmen, maid-ſervants and old clothes-women, &c. At firſt, every one won and no one loſt. Some of the pooreſt people gained in a few months houſes, coaches and horſes, and figured away like the firſt characters in the land.

* A perit is a ſmall weight leſs than a grain. T.

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In every town ſome tavern was ſelected which ſerved as a change, where high and low traded in flowers, and confirmed their bargains with the moſt ſumptuous entertainments. They formed laws for themſelves, and had their notaries and clerks.

When one reflects ſeriouſly on this trade, one will readily perceive, that to get poſſeſſion of theſe flowers was not the real object of it, though many have repreſented it in that light. The price of tulips roſe always higher from the year 1634 to the year 1637; but had the object of the purchaſer been to get poſſeſſion of the flowers, the price in ſuch a length of time muſt have fallen inſtead of riſen. "Raiſe the prices of the productions of agriculture, when you wiſh to reduce them," ſays Young; and in this he is undoubtedly right, for a great conſumption cauſes a greater reproduction. This has been ſufficiently proved by the price of aſparagus at Gottingen. As it was much ſought after, and large prices paid for it, more of it was planted, and the price has fallen. In like manner plantations of tulips would have in a ſhort time been formed in Holland, and floriſts would have been able to purchaſe flowers at a much lower price. But this was not done; and the chimney-ſweeper, who threw aſide his beſom, did not become a gardener, though he was a dealer in flowers. Roots would have been imported from diſtant countries, as aſparagus was

from

from Hanover and Brunſwick to Gottingen; the high price would have induced people to go to Conſtantinople to purchaſe roots, as the Europeans travel to Golconda and Viſapour to procure precious ſtones: but the dealers in tulips confined themſelves to their own country, without thinking of long journeys. I will allow that a flower might have become ſcarce, and conſequently dearer; but it would have been impoſſible for the price to riſe to a great height, and continue ſo for a year. How ridiculous would it have been to have purchaſed uſeleſs roots with their weight of gold, if the poſſeſſion of the flower had been the only object! Great is the folly of mankind; but they are not fools without a cauſe, as they would have been under ſuch circumſtances.

During the time of the Tulipomania, a ſpeculator often offered and paid large ſums for a root which he never received, and never wiſhed to receive. Another ſold roots which he never poſſeſſed or delivered. Oft did a nobleman purchaſe of a chimney-ſweep tulips to the amount of 2000 florins, and ſold them at the ſame time to a farmer; and neither the nobleman, chimney-ſweep, or farmer had roots in their poſſeſſion, or wiſhed to poſſeſs them. Before the tulip ſeaſon was over, more roots were ſold and purchaſed, beſpoke, and promiſed to be delivered, than in all probability were to be found in the gardens of Holland; and when Semper Auguſtus was not to be had, which hap-

happened twice, no ſpecies perhaps was oftener purchaſed and ſold. In the ſpace of three years, as Munting tells us, more than ten millions were expended in this trade, in only one town of Holland.

To underſtand this gambling traffic, it may be neceſſary to make the following ſuppoſition. A nobleman beſpoke of a merchant a tulip root, to be delivered in ſix months, at the price of 1000 florins. During theſe ſix months the price of that ſpecies of tulip muſt have riſen or fallen, or remained as it was. We ſhall ſuppoſe, that at the expiration of that time the price was 1,500 florins; in that caſe, the nobleman did not wiſh to have the tulip, and the merchant paid him 500 florins, which the latter loſt and the former won. If the price was fallen when the ſix months were expired, ſo that a root could be purchaſed for 800 florins, the nobleman then paid to the merchant 200 florins, which he received as ſo much gain; but if the price continued the ſame, that is 1000 florins, neither party gained or loſt. In all theſe circumſtances, however, no one ever thought of delivering the roots or of receiving them. Henry Munting, in 1636, ſold to a merchant at Alkmar, a tulip root for 7000 florins, to be delivered in ſix months; but as the price during that time had fallen, the merchant paid, according to agreement, only ten per cent. "So that my father," ſays the ſon, "received 700 florins for nothing; but

but he would much rather have delivered the root itſelf for 70 florins." The term of theſe contracts was [illegible] longer, and on that account [illegible] in proportion as more people by [illegible]ſic, more engaged in it; and thoſe who had money to pay to one, had ſoon money to receive of another; as at faro, one loſes upon one card, and at the ſame time wins on another. The tulip dealers often diſcounted ſums alſo, and tranſferred their debts to one another; ſo that large ſums were paid without caſh, without bills, and without goods, as by the *Virements* at Lyons. The whole of this trade was a game at hazard, as the Miſſiſippi trade was afterwards, and as ſtock-jobbing is at preſent. The only difference between the tulip trade and ſtock-jobbing is, that at the end of the contract the price in the latter is determined by the Stock-exchange; whereas in the former it was determined by that at which moſt bargains were made. High and low priced kinds of tulips were procured, in order that both the rich and the poor might gamble with them; and the roots were weighed by perits, that an imagined whole might be divided, and that people might not only have whole, but half and quarter lots. Whoever is ſurpriſed that ſuch a traffic ſhould become general, needs only to reflect upon what is done where lotteries are eſtabliſhed, by which trades are often neglected, and even abandoned, becauſe a ſpeedier mode of getting fortunes is pointed out to the

lower

lower claſſes. In ſhort, the tulip trade may very well ſerve to explain ſtock-jobbing, of which ſo much is written in gazettes, and of which ſo many talk in company without underſtanding it; and I hope on that account, I ſhall be forgiven for employing ſo much time in illuſtrating what I ſhould otherwiſe have conſidered as below my notice.

At length, however, this trade fell all of a ſudden. Among ſuch a number of contracts many were broken; many had engaged to pay more than they were able; the whole ſtock of the adventurers was conſumed by the extravagance of the winners; new adventurers no more engaged in it; and many becoming ſenſible of the odious traffic in which they had been concerned, returned to their former occupations. By theſe means, as the value of tulips ſtill fell, and never roſe, the ſellers wiſhed to deliver the roots *in natura* to the purchaſers at the prices agreed on; but as the latter had no deſire for tulips at even ſuch a low rate, they refuſed to take them or to pay for them. To end this diſpute, the tulip-dealers of Alkmar ſent in the year 1637 deputies to Amſterdam, and a reſolution was paſſed on the 24th of February, that all contracts made prior to the laſt of November 1636 ſhould be null and void; and that, in thoſe made after that date, purchaſers ſhould be free on paying ten per cent. to the vender.

The more diſguſted people became with this trade, the more did complaints increaſe to the magiſtrates of

of the different towns; but as the courts there would take no cognizance of it, the complainants applied to the States of Holland and Weſt Frieſland. Theſe referred the buſineſs to the determination of the provincial council at the Hague, which on the 27th of April 1637 declared, that it would not deliver its opinion on this traffic until it had received more information on the ſubject; that in the mean time every vender ſhould offer his tulips to the purchaſer; and, in caſe he refuſed to receive them, the vender ſhould either keep them, or ſell them to another, and have recourſe on the purchaſer for any loſs he might ſuſtain. It was ordered alſo, that all contracts ſhould remain in force till farther enquiry was made. But as no one could foreſee what judgment would be given reſpecting the validity of each contract, the buyers were more obſtinate in refuſing payment than before; and venders, thinking it much ſafer to accommodate matters amicably, were at length ſatisfied with a ſmall profit inſtead of exorbitant gain: and thus ended this extraordinary traffic, or rather gambling.

It is however certain, that perſons fond of flowers, particularly in Holland, have paid, and ſtill pay, very high prices for tulips, as the catalogues of floriſts ſhew *. This may be called the

* In the year 1769, the deareſt kinds in England were *Don Quevedo* and *Valentinier*; the former coſt 2*l.* 2*s.* and the latter 2*l.* 12*s.* 6*d.* See Weſton's *Botanicus Univerſalis*, part 2d. In the German catalogues none of the prices are ſo high. The name *Semper Auguſtus* is not once to be found in new catalogues.

leſſer Tulipomania, which has given occaſion to many laughable circumſtances. When John Balthaſar Schuppe was in Holland, a merchant gave a herring to a ſailor who had brought him ſome goods. The ſailor, ſeing ſome valuable tulip roots lying about, which he conſidered as of little conſequence, thinking them to be onions, took ſome of them unperceived, and ate them with his herring. Through this miſtake the ſailor's breakfaſt coſt the merchant a much greater ſum than if he had treated the Prince of Orange. No leſs laughable is the anecdote of an Engliſhman who travelled with Matthews. Being in a Dutchman's garden, he pulled a couple of tulips, on which he wiſhed to make ſome botanical obſervations, and put them in his pocket; but he was apprehended as a thief, and obliged to pay a conſiderable ſum before he could obtain his liberty *.

Reimman and others accuſe Juſt. Lipſius of the Tulipomania †; but if by this word we underſtand that gambling traffic which I have deſcribed, the accuſation is unfounded. Lipſius was fond of ſcarce and beautiful flowers, which he endeavoured to procure by the aſſiſtance of his friends, and which he cultivated himſelf with great care in his garden; but this taſte can be by no means called a mania §. Other learned men of the ſame age were

* Blainville's Travels.

† Reimman's Introductio in Hiſtor. Litterariam, iii. 3. p. 92.

§ That he might relax and refreſh his mind worn out by ſtudy, he amuſed himſelf with the cultivation of his garden and of flowers, and

were fond of flowers, ſuch as John Barclay *, Pompeius de Angelis †, and others, who would probably have been ſo, even though the cultivation of flowers had not been the prevailing taſte. It however cannot be denied, that learned men may be infected with epidemical follies. In the preſent age, many have become phyſiognomiſts, becauſe phyſiognomy is in faſhion; and even animal magnetiſm has met with partiſans to ſupport it.

and particularly of tulips, the roots of which he was at great pains to procure from all parts of the world, by means of Dodoneus, Cluſius, and Boiſotus, men ſingularly well ſkilled in horticulture and by others of his friends.—Here, at a diſtance from civil tumult, with a cheerful countenance and placid eye, he ſauntered through his plants and flowers, contemplating ſometimes one declining, ſometimes another ſpringing up, and forgetting all his cares amidſt the pleaſure which theſe objects afforded him. See the Life of Lipſius, prefixed to the edition of his works printed at Antwerp in 1637. The like account is to be found in *Adami Vitæ philoſophorum*. This is confirmed by what Lipſius ſays himſelf in his book *De Conſtantia*, ii. 2, 3. in praiſe of gardening.

* He rented a houſe near to the Vatican, with a garden, in which he had planted the choiceſt flowers, and thoſe chiefly which are not propagated from ſeeds or roots, but from bulbs. Theſe flowers were not known about thirty years before, nor had they been ever ſeen at Rome, but lay neglected in the Alps.—Of theſe flowers, which have no ſmell, but are eſteemed only on account of their colours, Barclay was remarkably fond, and purchaſed their bulbs at a great price. *Erythræi Pinacotheca*. Lipſiæ 1712. 8vo. iii. 17. p. 623. See alſo *Pauli Freheri Theatrum*, p. 1515.

† Erythr. Pinacoth. iii. 24. p. 650.

CANARY BIRD.

THIS little bird, highly eſteemed for its ſong, which is reared with ſo much care, particularly by the fair ſex, and which affords an innocent amuſement to thoſe who are fond of the wild notes of nature, is a native of thoſe iſlands from which it takes its name. As it was not known in Europe till the fifteenth century, no account of it is to be met with in any of the works of the old ornithologiſts. Bellon, who about the year 1555 deſcribed all the birds then known, does not ſo much as mention it. At that period it was brought from the Canary Iſlands. It was therefore ſo dear that it could be procured only by people of fortune, and thoſe who purchaſed were even often impoſed on*. It was called the ſugar-bird, becauſe it was ſaid to be fond of the ſugar-cane, and that it could eat ſugar in great abundance. This circumſtance ſeems to be very ſingular; for that ſalt is to many fowls a poiſon. Experiments have ſhewn, that a pigeon to which four drams of ſugar was given died in four hours, and that a duck which had ſwallowed five drams did not live ſeven hours after. It is certain, therefore, that the power of poiſon is relative.

The firſt figure of this bird is given by Aldro-

* Geſneri Hiſtoriæ Animalium liber tertius. Tiguri 1555. fol. p. 234.

vandus,

vandus *, but it is ſmall and inaccurate. That naturaliſt reckons the Canary bird among the number of thoſe which were ſcarce and expenſive, as it was brought from a diſtant country with great care and attention. The firſt good figure of it is to be found in Olina †: it has been copied by both Johnſton and Willughby.

In the middle of the laſt century theſe birds began to be bred in Europe, and to this the following circumſtance, related by Olina, ſeems to have given occaſion. A veſſel, which, among other commodities, was carrying a number of Canary birds to Leghorn, was wrecked on the coaſt of Italy; and theſe birds, being thus ſet at liberty, flew to the neareſt land, which was the Iſland of Elba, where they found the climate ſo favourable, that they multiplied, and perhaps would have become domeſticated, had they not been caught in ſnares; for it appears that the breed of them there has been long ſince deſtroyed ‡. Olina ſays, that the breed ſoon degenerated; but it is probable that theſe Canary birds, which were perhaps all males, did at the Iſland of Elba what the European ſailors do in India. By coupling with the birds of the iſland, they may have produced

* Aldrovandi Ornithologiæ tomus alter. Francofurti 1610. fol. p. 355. tab. 14. fig. 31.

† Uccelliera, overo Diſcorſo della natura di diverſi uccelli—opera di Gio. Pietro Olina. In Roma 1622. 4to. p. 7.

‡ They are not named by Koſtlin among the birds which he obſerved at Elba.

mules. Such baſtards are deſcribed by Geſner and other naturaliſts *.

The breeding of theſe birds was at firſt attended with great difficulty; partly becauſe the treatment and attention they required were not known, and partly becauſe males chiefly, and few females, were brought to Europe. We are told, that the Spaniards once forbade the exportation of males, that they might ſecure to themſelves the trade carried on in theſe birds, and that they ordered the bird-catchers, either to ſtrangle the females or to ſet them at liberty †. But this order ſeems to have been unneceſſary; for, as the females commonly do not ſing, or are much inferior in the ſtrength of their notes to the males, the latter only were ſought after as objects of trade. In the like manner, as the male parrots are much ſuperior in colour to the females, the males are more eſteemed, and more of them are brought to Europe than of the females. It is probable, therefore, that, in our ſyſtem of ornithology, many female parrots belonging to a ſpecies already well known are conſidered as a diſtinct ſpecies. It

* Geſneri redivivi, aucti et emendati tomus ii. Franc. 1669. fol. p 62. More information reſpecting ſuch baſtards may be found in Ornithologie par Briſſon, t. iii. Paris 1760. 4to. p. 187. Hallens Naturgeſchichte der Thiere, ii. p. 370. and Friſch, Vorſtellung der vogel in Teutſchland, the twelfth plate of which contains ſeveral good figures.

† Coleri Oeconomia ruralis et domeſtica. Franc. 1680. folio. i. p. 621.

was

was at firſt believed, that thoſe Canary birds bred in the Canary Iſlands were much better ſingers than thoſe reared in Europe*; but this at preſent is doubted†. In latter times various treatiſes have been publiſhed in different languages, on the manner of breeding theſe birds, and many people have made it a trade, by which they have acquired conſiderable gain. It does no diſcredit to the induſtry of the Tyrolians that they have carried it to the greateſt extent. At Ymſt, there is a company, who, after the breeding ſeaſon is over, ſend out perſons to different parts of Germany and Swiſſerland to purchaſe birds from thoſe who breed them. Each perſon brings with him commonly from three to four hundred, which are afterwards carried for ſale, not only through every part of Germany, but alſo to England, Ruſſia, and even Conſtantinople. About ſixteen hundred are brought every year to England; where the dealers in them, notwithſtanding the conſiderable expence they are at, and after carrying them about on their backs, perhaps a hundred miles, ſell them for five ſhillings a piece. This trade, hitherto neglected, is now carried on in Schwarzwalde; and at preſent there is a citizen here at Gottingen, who takes with him every year to England

* General hiſtory of America, with Baumgarten's preface, vol. i. p. 557.

† Barrington's paper in the Philoſ. Tranſ. vol. lxiii. p. 249.

ſeveral Canary birds and bulfinches *(loxia pyrrhula)*, with the produce of which he purchaſes ſuch ſmall wares as he has occaſion for.

The principal food of theſe birds is the Canary ſeed, which, as is commonly affirmed, and not improbably, was firſt brought, for this purpoſe, from the Canary Iſlands to Spain, and thence diſperſed all over Europe. Moſt of the old botaniſts, however, are of opinion, that the plant which produces it is the ſame as that called *phalaris* by Dioſcorides *. If this be true, then muſt it be allowed that this kind of graſs muſt have grown wild in other places beſides the iſland it takes its name from; which is not improbable. When one, however, reads the different deſcriptions which the ancients have given of *phalaris*, one will, in my opinion, obſerve that they may be equally applied to more plants; and Pliny ſeems to have uſed this name for more than one ſpecies of graſs †.

However this may be, it is certain that this ſeed, when it was uſed as food for theſe birds, began to be cultivated firſt in Spain, and afterwards in the ſouthern parts of France. At preſent it is cultivated in various parts, and forms no inconſiderable branch of trade, particularly in the iſland of Sicily ‡, where the plant is called *Scagliuola*, or

* Phalaris Canarienſis. The beſt figure and deſcription of it are to be found in Schreber's *Beſchreibung der Graſer*, ii. p. 83. tab. x. 2.

† Lib. iii. c. 159. and lib. xxvii. c. 12.

‡ Agricoltura, prodotti e commercio della Sicilia; dell' Ab. Domenico Seſtini 1778.

Scaghiola. The ſeed is ſold principally to the French and the Genoeſe. In England, the induſtrious inhabitants of the Iſle of Thanet, particularly thoſe around Margate, gain conſiderably by this article, as they can eaſily tranſport it to London by water *.

That this plant might be cultivated with little trouble in Germany, is ſhewn by the yearly experience of thoſe who raiſe it in their gardens, and by its having become ſo naturalized in ſome parts in Heſſe †, that it propagates by ſeed of itſelf in the fields. The uſe of the ſeed might alſo be extended, for it yields a good meal; but the grains are not eaſily freed from the huſks.

I ſhall here take occaſion to remark, that Savary ‡ has been guilty of an error, when he ſays that argol is cultivated in the Canary Iſlands in order to be ſold as food for Canary birds. One may eaſily perceive that this miſtake has ariſen from his confounding that moſs uſed for dyeing, with this kind of graſs; and I ſhould not have conſidered it worth notice, had it not been copied into Ludovici's Dictionary of Trade ||, from which, perhaps, it may be copied into the works of others.

* Miller's Gardener's Dictionary. Muſeum Ruſticum.

† C. Moench, Enumeratio plantarum Haſſiæ inferioris. Caſſellis 1777. 8vo. p. i. 24.

‡ Dictionnaire de Commerce. t. v. Copenhague 1765. fol. p. 1149.

|| In the laſt edition of 1765, ii. p. 128.

ARGOL.

UNDER the names Orſeille, Orceille, Orſolle, Urſolle, Orcheil, Orchel, in Italian Oricello *, Orcella, Roccella, in Dutch Orchillie, and in Engliſh Argol, Canary weed or Orchilla weed, is underſtood a moſs uſed for dyeing, and from which a kind of paint is alſo prepared. This ſpecies of moſs, of which the beſt figure and a full deſcription may be ſeen in Dillen †, is by Linnæus called *Lichen roccella*. It is found, in abundance, in ſome of the iſlands near the African coaſt, particularly in the Canaries, and in ſeveral of the iſlands in the Archipelago. It grows upright, partly in ſingle partly in double ſtems, which are about two inches in height. When it is old, theſe ſtems are crowned with a button ſometimes round, and ſometimes of a flat form, which Tournefort, very properly, compares to the excreſcences on the arms of the ſepia. Its colour is ſometimes a light, and ſometimes a dark grey. Of this moſs with lime, urine and alkaline ſalts, is formed a dark red paſte, which in commerce has the ſame name, and which is much

* In the Dictionary of the Academy della Cruſca the word *oricello* is thus explained: Tintura colla quale ſi tingono i panni, che ſi fa con orina d'uomo, e con altri ingredienti.

† Dillenii Hiſtoria muſcorum. Oxonii 1741. 4to. p. 120.

uſed

uſed in dyeing. That well-known ſubſtance called lacmus is alſo made of it.

Theophraſtus *, Dioſcorides †, and their tranſcriber Pliny ‡, give the name of *Phycos thalaſſion* or *pontion* to a plant, which, notwithſtanding its name, is not a ſea weed but a moſs; as it grew on the rocks of different iſlands, and particularly on thoſe of Crete or Candia. It had, in their time, been long uſed for dyeing wool, and the colour it gave when freſh was ſo beautiful, that it excelled the ancient purple, which was not red, as many ſuppoſe, but violet. Pliny tells us, that with this moſs dyers gave the ground or firſt tint to thoſe cloths which they intended to dye with the coſtly purple. At leaſt, I ſo underſtand, with Hardouin and others, the words *conchyliis ſubſternitur*, which

* Alga marina, το ποντιον φυκος, quam ſpongiarii pelagicam deferunt, in Creta inſula, juxta terram, ſuper ſaxa plurima optimaque provenit, qua non ſolum vittas, ſed etiam lanas veſteſque inficiunt, et quamdiu recens infectio ſit, color longe purpuram præſtat. *Hiſt. Plant.* iv. c. 7. p. 82. *ed. Heinſii.*

† E phyci marini generibus tertium candidum, naſcens in Creta, floridum valde, quod nulla corruptionis labe polluitur. Hoc fuco quidam putant mulieres ſuum colorem mentiri, cum tamen ſit radicula ejuſdem nominis qua ſe fucant. Lib. iv. c. 95.

‡ Phycos thalaſſion, id eſt fucus marinus, lactucæ ſimilis, qui conchyliis ſubſternitur. Tria autum genera ejus. Tertium criſpis foliis, quo in Creta veſtes tingunt; omnia ejuſdem uſus. Lib. xxvi. c. 10.

Algæ maris plurima genera, uti diximus, longo folio et latiore, rubente, aliave criſpo. Laudatiſſima quæ in Creta inſula juxta terram in petris naſcitur; tingendis etiam lanis ita colorem alligans, ut elui poſtea non poſſit. Lib. xxxii. c. 6.

the

the French dyers expreſs by the phraſe *donner le pied.*

Though ſeveral kinds of moſs produce a ſimilar red dye, I agree in opinion with Dillen, that *phycos thalaſſion* is our argol; for, at preſent, no ſpecies is known which communicates ſo excellent a colour, and which correſponds ſo nearly with the deſcription of Theophraſtus. Beſides, it is ſtill collected in the Grecian iſlands, and it appears that it has been uſed there ſince the earlieſt ages *.

Tournefort † found this moſs in the iſland Amorgos, which lies on the eaſtern ſide of Naxos, and which, at preſent, is called Morgo. In his time it was ſent to England and Alexandria, at the rate of ten rix-dollars per hundred weight; and he ſays, expreſſly, that it was common in the other iſlands. He ſhews from Suidas, Julius Pollux ‡, and other ancient writers, that this iſland was once celebrated for a kind of red linen cloth, which in commerce had the name of the iſland;

* Hardouin quotes *Ariſtot. Hiſt. Animal.* vi. c. 9. edit. Scaligeri. But that naturaliſt ſpeaks of a ſea weed which was caſt on ſhore by the Helleſpont. A dye or paint was made of it, and the people in the neighbourhood imagined that the purple of this ſea weed, which ſerved as food to certain ſhell fiſh, communicated to them their beautiful dye. A proof that ſea weed *(fuci)* can communicate a red colour, may be found in the Tranſactions of the Swediſh Academy, iv. p. 29.

† Voyage du Levant. Amſterd. 1718. 4to. i. p. 89.

‡ Præterea Amorgina, optima quidem in Amorgo fiunt, ſed et hæc e lino eſſe aſſerunt. Tunica autem Amorgina, etiam amorgis nuncupatur. *Onomaſticon*, vii. c. 16.

and

and he conjectures, not without probability, that it might have been dyed with this moſs.

Imperati * ſays, that the *roccella* of which he gives a figure, was procured from the Levant. This naturaliſt gives the figure alſo of a moſs in Candia, uſed for dyeing, which was then called *rubicula*, and which, as may be ſeen in Bauhin †, is comprehended under the name of Roccella. Whether this be a variation from that ſpecies cannot with certainty be determined, from the few obſervations on which the characteriſing of the cryptogamia claſs of plants depends. Dillen and Linnæus, however, make it a diſtinct ſpecies; and the latter names it *lichen fuciformis*. This diſtinction is, perhaps, not improper; for the *rubicula* does not grow like a ſhrub or buſh, as the roccella, but belongs rather to the leafy-formed moſſes. Be this as it may, it is certain, as Dillen has remarked, and as I know from my own obſervation, that *L. fuciformis* is often mixed with the real roccella, and particularly with that brought from the Canary Iſlands; but whether it be equally good, experience has not yet taught us.

From what has been ſaid, I think, I may venture to conclude that our argol was not unknown to the ancient Grecians. But when was it firſt employed as a dye by the moderns, and introduced into our commerce? Some writers are of

* Hiſtor. nat. Coloniæ 1695. 4to. lib. xxvii. c. 11.

† Pinax plant. p. 365. Hiſt. plant. iii. 2. p. 796.

opinion,

opinion, that this drug was firſt found in the Canary Iſlands, and afterwards in the Levant. The uſe of it, therefore, is not older than the laſt diſcovery of that iſland. That this opinion is falſe, will appear from what follows.

Among the oldeſt and principal Florentine families is that known under the name of the Oricellarii or Rucellarii, Ruſcellai or Rucellai, ſeveral of whom have diſtinguiſhed themſelves as ſtateſmen, and men of letters *. This family are deſcended from a German nobleman, named Ferro or Frederigo, who lived in the beginning of the twelfth century †. One of his deſcendants, in the year 1300, carried on a great trade in the Levant, by which he acquired conſiderable riches, and returning at length to Florence, with his fortune, firſt made known in Europe the art of dyeing with argol. It is ſaid, that a little before his return from the Levant, happening to make water on a rock covered with this moſs, he obſerved, that the plant, which was there called *reſpio* or *reſpo*, and in Spain *orciglia*, acquired by the urine a purple, or, as others ſay, a red colour. He, therefore, tried ſeveral experiments; and when

* Bayle, in his Dictionary, mentions ſeveral diſtinguiſhed perſons of this family, ſome of them under the name of Oricellarius, and others under that of Rucellai. He ſhews that they all belong to one ſtock; but of the origin of the name he ſeems to have been ignorant.

† Other accounts ſay that he was an Engliſhman; but the name Frederigo confirms his German extraction.

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he had brought to perfection the art of dyeing wool with this plant, he made it known at Florence, where he alone practiſed it for a conſiderable time, to the great benefit of the ſtate. From this uſeful invention, the family received the name of Oricellarii, from which, at laſt, was formed Rucellai *.

As ſeveral documents, ſtill preſerved among the Florentine archives, confirm the above account of the origin of this family name, from the diſcovery

* A particular account of this celebrated family is to be found in *Giornale de' Letterati d' Italia*, t. xxxiii. parte i. p. 231. As that extenſive work is not common, I ſhall here tranſcribe the whole paſſage. "Among the moſt ancient and moſt illuſtrious families of the city of Florence is that of the Rucellai, which is ſaid to have been tranſplanted thither, a little after the eleventh century, by a certain military gentleman named Ferro or Frederigo, who came from Germany, where he was honoured on account of the nobility of his birth. This family were called, according to the Latin mode of termination, Oricellarii, which ſurname was afterwards variouſly corrupted into Rucellari, Ruſcellai, but more commonly into Rucellai. This ſurname, we are told, took its riſe from one of the family, who, about the year 1300, having returned from the Levant, where he had traded many years, and acquired great wealth, brought with him the art of dyeing wool purple, which is called dyeing *in oricello:* for, being about to embark for his own country, he happened to make water on certain plants; and obſerving that ſome of them, which had been only beſprinkled by the urine, from being green became red, he plucked up one of them, and, having ſhewn it, found that, in that country, it was called *reſpio*, and in Spain *orciglia*, and that it was the ſame as that to which the name of *corallina* was given by botaniſts. In remembrance of this diſcovery, he and his poſterity were, afterwards, called *Oricellarii*; which name, by being pronounced ſhort, and a little mutilated, was changed into *Rucellari*, and laſtly into *Rucellai*."

of

of dyeing with oricello *, we may, in my opinion, conſider it as certain that the Europeans, and firſt the Florentines, were made acquainted with this dye-ſtuff, and its uſe, in the beginning of the fourteenth century. At that time, the Italians brought from the Eaſt the ſeeds of many arts and ſciences, which, afterwards ſown and

* Theſe documents from the Florentine records may be found in *Dominici Mariæ Manni de Florentinis Inventis Commentarium.* Ferrariæ 1731, 4to. p. 37. from which I have extracted the following: "One of this family reſided, formerly, a long time in the Levant, where he caried on trade, according to the cuſtom of the Florentine nation. Being one day in the fields, and happening to make water on a plant, of which there was great abundance, he obſerved that it immediately became extraordinarily red. Like a prudent man, therefore, he reſolved to make uſe of this ſecret of nature, which till that time had lain hid; and having made ſeveral experiments on that herb, and finding it proper to dye cloth, he ſent ſome of it to Florence, where, being mixed with human urine and other things, it has always been employed to dye cloth purple. This plant, which is called *reſpo*, is in Spain called *orciglia*, and by botaniſts commonly *corallina.* The mixture made with it is called *oriecllo*, and has been of great utility and advantage to the woollen manufacture, which is carried on to greater extent in Florence than in any other city. From this circumſtance the individuals of that family, by being the inventors of oricello, have been called Oricellai, and have been beloved by the people for having procured to them this particular benefit. Thus has written John di Paolo Rucellai [*Manni ſays, that this learned and opulent man wrote in the year* 1451]; and the ſame account is ſtill given by dyers, in our city, who relate and affirm that their anceſtors have for a century exerciſed the art of dyeing, and that they know the above from tradition."

This is confirmed by another paſſage: "One of this family, on account of the trade carried on faithfully and honeſtly by the Florentines, travelled to the Levant, and brought thence to Florence the art, or rather ſecret, of dyeing in oricello."

nurtured

nurtured in Europe, produced the richeſt harveſts; and nothing is more certain than that the art of dyeing was brought to us from the Eaſt by the Italians. I do not believe that the merit of having diſcovered this dye, by the above-mentioned accident, is due to that Florentine; but I am of opinion that he learned the art in the Levant, and, on his return, taught it to his countrymen, which was doing them no ſmall ſervice *. After that period, the Italians alone procured argol from the Levant for themſelves, and afterwards for all Europe. I ſay for a long time, becauſe ſince the diſcovery of the Canary-Iſlands the greater part of that ſubſtance has been procured from them.

Theſe iſlands, after being a long time loſt and forgotten, were again diſcovered about the end of the fourteenth or the beginning of the fifteenth century, and ſince that time they have been much frequented by the Europeans. One of the firſt who endeavoured to obtain an eſtabliſhment there was John de Betancourt, a gentleman of Norman-

* In the genealogical hiſtory of the noble families of Tuſcany and Umbria, written by P. D. Eugenio Gamurrini, and publiſhed at Florence 1668—1673, 3 vols. in folio, is the following account, vol. i. p. 274. of the origin of this family. This family acquired their name from a ſecret brought by one of them from the Levant, which was that of dyeing in oricello, never before uſed in this country. On that account, they were afterwards called Oricellari, as appears from ſeveral records among the archives of Florence, and then by corruption Rucellari and Rucellai. Of their origin many ſpeak, and all agree that they came into Tuſcany from Britain.

dy, who, in 1400, or, as others ſay, in 1417, landed on Lancerotta. Amongſt the principal commodities which this gentleman and other Europeans brought back with them was argol, which was found there more beautiful, and in greater abundance, than any where elſe; and Betancourt enjoyed in idea the great profit which he hoped to derive from this article in commerce. Glaſs is ſurpriſed that the Europeans, immediately upon their arrival, ſought after this moſs with as much eagerneſs and ſkill as they did after gold in America, though they were not ſo well acquainted with the former as the latter, before the diſcovery of theſe new lands*. But as this is not true, the wonder will ceaſe.

According to information procured in the year 1731, the iſland of Teneriff produced annually five hundred quintals of this moſs; Canary, four hundred; Forteventura, Lancerotta, and Gomera, three hundred each; and Fero eight hundred; making in all two thouſand ſix hundred quintals. In the iſlands of Canary, Teneriff and Palma, the moſs belongs to the crown; and in the year 1730 it was let by the king of Spain for one thouſand five hundred piaſtres. The farmers paid then for collecting it from fifteen to twenty rials per hundred weight. In the reſt of the iſlands it belongs to

* The hiſtory of the diſcovery and conqueſt of the Canary-Iſlands, by George Glaſs. London 1764. 4to.

private

private proprietors, who cauſe it to be collected on their own account. In the beginning of this century a hundred weight, delivered on board at Santa Cruz the capital of Teneriff, was worth from only three to four piaſtres; but ſince 1725 it has coſt labour amounting to ten piaſtres, becauſe it has been in great requeſt at London, Amſterdam, Marſeilles, and throughout all Italy *. In the year 1726 this moſs coſt at London eighty pounds ſterling per ton, as we are told by Dillen; and in 1730 it bore the ſame price.

Towards the end of the year 1730, the captain of an Engliſh veſſel, which came from the Cape de Verd iſlands, brought a bag of argol to Santa Cruz, by way of trial. He diſcovered his ſecret to ſome Spaniſh and Genoeſe merchants, who, in the month of July 1731, reſolved to ſend a ſhip to theſe iſlands. They landed on that of St. Anthony and St. Vincent, where, in a few days, they obtained five hundred quintals of this moſs, which they found in ſuch abundance, that it coſt them nothing more than a piaſtre per cent. by way of preſent to the governor. The argol of the Cape de Verd iſlands appears larger, richer, and longer than that of the Canaries; and this, perhaps, is

* This information is to be found in Hellot's Art of dyeing, into which it has been copied, as appears by *Dictionnaire d'hiſtoire naturelle par Valmont de Bomare*, from an account written by M. Portier, who was conſul at Teneriff in 1731.

owing to its not being collected every year *. Adanſon, in 1749, found alſo the greater part of the rocks in Magdalen iſland, near Senegal, covered with this moſs †. Though the greater part of our argol is, at preſent, procured from the Canary and Cape de Verd iſlands, a conſiderable quantity is procured alſo from the Levant, from Sicily as Glaſs ſays, and from the coaſt of Barbary; and ſome years ago the Engliſh merchants at Leghorn cauſed this moſs to be collected in the iſland of Elba, and paid a high price for it ‡.

Our dyers do not purchaſe raw argol, but a paſte made of it, which the French call *orſeille en pâte*. The preparation of it was for a long time kept a ſecret by the Florentines. The perſon who, as far as I know, made it firſt known was Roſetti; who, as he himſelf tells us, carried on the trade of dyer at Florence. Some information was afterwards publiſhed concerning it by Imperati || and Micheli the botaniſt ¶. In latter times this art has

* As the argol grows in the African iſlands, and on the coaſt of Africa, Glaſs ſuppoſes that the Getulian purple of the ancients was dyed with it; but this opinion is improbable, for Horace praiſes Gætula *murice* tinctas veſtes.

† Hiſtoire naturelle du Senegal. Paris 1757. 4to. p. 66.

‡ Lettres ſur l'hiſtoire naturelle de l'iſle d'Elbe, par Koeſtlin. Vienne 1780. 8vo. p. 100. Pini Beobachtungen über die eiſengruben bey Rio; uberſeſst von I. F. Gmelin. Halle 1780. 8vo. p. 97.

|| Lib. xxvii. c. 9.

¶ Nova plantarum genera. Florenciæ 1729.

been

been much practiſed in France, England, and Holland. Many druggiſts, inſtead of keeping this paſte in a moiſt ſtate with urine, as they ought, ſuffer it to dry, in order to ſave a little dirty work. It then has the appearance of a dark violet-coloured earth, with here and there ſome white ſpots in it.

The Dutch, who have found out better methods than other nations of manufacturing many commodities, ſo as to render them cheaper, and thereby to hurt the trade of their neighbours, are the inventors alſo of lacmus *, a preparation of argol, called *orſeille en pierre*, which has greatly leſſened the uſe of that *en pâte*, as it is more eaſily tranſported and preſerved, and fitter for uſe; and as it is beſides, if not cheaper, at leaſt not dearer. This art conſiſts, undoubtedly, in mixing with that commodity ſome leſs valuable ſubſtance, which either improves or does not much impair its quality, and which at the ſame time increaſes its weight †. Thus do they pound cinnabar and ſmalt finer than other nations, and yet ſell both theſe articles cheaper. Thus do they ſift cochineal, and ſell it cheaper than what is unſifted.

It was for a long time believed that the Dutch

* Some tranſlate this word *lacca muſica*, *muſiva*.

† As dry lacmus is much cheaper than moiſt, it may be readily ſuppoſed that it is adulterated with ſand and other ſubſtances. *Valentini Hiſtoria ſimplicium*. Francf. ad Moen. 1716. fol. p. 152.

prepared their lacmus from thoſe linen rags which in the ſouth of France are dipped in the juice of the *croton tinctorium* * ; and this idea appeared the more probable, as moſt of theſe *tourneſol en drapeaux* were bought up by the Hollanders : but, as they are the greateſt adulterators of wine in Europe, they may perhaps have uſed theſe rags to colour Pontack and other wines. It is, however, not improbable that they at firſt made lacmus of them, as their dye approaches very near to that of argol. At preſent, it is almoſt certainly known that *orſeille en pâte* is the principal ingredient in *orſeille en pierre*, that is in lacmus ; and for this curious information we are indebted to Ferber†. But whence ariſes the ſmell of the lacmus, which appears to me like that of the Florentine iris ? Some of the latter may, perhaps, be mixed with it ; for I think I have obſerved in it ſmall indiſſo-

* This plant grows in the neighbourhood of Montpellier, and, above all, in the flats of Languedoc. In harveſt, the time when it is collected, the peaſants aſſemble from the diſtance of fifteen or twenty leagues around, and each gathers on his own account. It is pounded in a mill, and the juice muſt be immediately uſed : ſome mix with it a thirtieth part of urine. It is poured over pieces of canvas, which they take care to provide, and which they rub between their hands. Theſe rags are dried in the ſun, and then expoſed, above a ſtone ſtove, to the vapour of urine mixed with quick-lime or alum. After they have imbibed the juice of the plant, the ſame operations are repeated till the pieces of cloth appear of a deep blue colour. They are called in commerce *tourneſol en drapeau*. Large quantities of them are bought up by the Dutch, who make uſe of them to colour wines and the rinds of their cheeſe. TRANS.

† Linn. Mantiſſa plantarum, i. p. 132.

luble

luble particles, which may have been bits of the roots. The addition of this ſubſtance can be of no uſe to improve the dye; but it may increaſe the weight, and give the lack more body; and perhaps it may be employed to render imperceptible ſome unpleaſant ſmell, for which purpoſe the roots of that plant are uſed on many other occaſions.

Another kind of moſs, different from the roccella, which in commerce is known by the names *orſeille de terre*, *orſeille d'Auvergne*, is uſed alſo for the like purpoſe; but it contains fewer and weaker colouring particles. This ſpecies, in botany, is called *Lichen parellus* *, and is diſtinguiſhed from the roccella by its figure, as it grows only in a thin rind on the rocks. It is collected in Auvergne, on rocks of granite and volcanic productions, and in ſome parts of Languedoc: the greater part of it comes from St. Flour. Its name, *perelle*, comes from an old Languedocian word *père* (*pierre* a rock†); as *roccella*, afterwards transformed into *orſeille*, is derived from *rocca*. The uſe of *perelle* is very trifling: the Dutch purchaſe it to make lacmus, perhaps on account of its low price. This moſs has been found alſo in Northumberland, but it is not collected there for any purpoſe ‡.

* Linn. Mantiſſa plant. i. p. 132.

† See *Garcin*, in Savary's Dictionary of commerce, iii. p. 130.

‡ The natural hiſtory and antiquities of Northumberland. By John Wallis. London 1769. 2 vols. 4to. i. p. 279.

MAGNETIC CURES.

THE external uſe of the magnet, to cure the toothach and other diſorders, is a remedy brought into faſhion in modern times, but not a new diſcovery, as Leſſing thinks, who aſcribes it to Paracelſus *. It was known to Aetius, who lived ſo early as the year 500. That author ſays, We are aſſured that thoſe who are troubled with the gout in their hands or their feet, or with convulſions, find relief when they hold a magnet in their hand †. He does not, however, give any proof of this from his own experience; and perhaps he doubted the truth of it. The above paſſage contains the oldeſt account known at preſent reſpecting this virtue; for the more ancient writers ſpeak only of the internal uſe of the magnet.

It is evident, therefore, that this cure has not been diſcovered in latter times, but that it has been preſerved by the old phyſicians copying it from each other into their works. In the like manner, many things are mentioned in the mate-

* In his *Kollektaneen*. Berlin 1790. ii. p. 117.

† See the Aldine edit. of the works of Aetius. Venetiis 1534, fol. l. ii. c. 25. The paſſage is thus tranſlated by Cornarius: Tradunt (magnetem) detentum manu chiragrorum ac podagricorum dolores ipſorum ſedare. Æque convulſis opitulatur. In ſome editions, the laſt words are wanting. Perhaps they are not of Aetius.

ria medica which were uſed or propoſed by the ancients, but into the properties of which they never made ſufficient enquiry.

Marcellus, who lived in the fifteenth century, aſſures us that the magnet cures the toothach *. The ſame virtue is aſcribed to it by Leonard Camillus †, who lived in the ſixteenth century: and Wecker ‡, who was nearly cotemporary, ſays that the magnet, when applied to the head, cures the headach; and adds, that Holler had taken this cure from the works of the ancients ||. We read alſo in Porta §, that it was recommended for the headach; and in Kircher ¶, that it was worn about the neck

* Magnetes lapis (qui antiphyſon dicitur) qui ferrum trahit et abjicit, et magnetes lapis qui ſanguinem emittit et ferrum ad ſe trahit, collo alligati aut circa caput, dolori capitis medetur. *De medicamentis*, cap. 1. In *Stephani Artis med. princip.* ii. p. 253.

† Magnes geſtatus ſpaſmum arthriticum doloremque curat. *De lapidibus*, lib. ii. p. 131.

‡ Ad capitis dolores: magnes ipſe capiti admotus dolorem omneſque querelas ejus obliterat. Quod ex veterum commentariis ſe tranſtuliſſe ſcribit noſter Hollerius. *J. J. Wecker de ſecretis libri xvii.* Baſiliæ 1613. 8vo. lib. v. p. 107.

|| I took the trouble to ſearch, for this paſſage, in *Jac. Hollerii lib. de morbis internis*, Pariſiis 1711, 4to. but I could not find it, though the beginning of the book treats expreſsly of headachs.

§ Legimus et capiti admotum magnetem dolores omnes auferre. *J. Bap. Portæ Magiæ naturalis libri xx.* Francofurti 1591. 8vo. lib. vii. p. 332.

¶ Ex collo geſtatus magnes ſpaſmum ſanare, ac nervorum dolores compeſcere, manuque detentus partum accelerare, perhibetur. *Athan. Kircheri Magnes, ſive De arte magnetica.* Coloniæ Agrip. 1643. 4to. lib. iii. c. i. p. 679.

as

as a preventative againſt convulſions, and affections of the nerves. About the end of the laſt century magnetic tooth-picks and ear-pickers were made, which were extolled as a ſecret preventative againſt pains in the teeth, eyes and ears *. However this may be, later and more accurate experiments have fully ſhewn that the magnet has an external effect on the bodies of animals—a phenomenon, the inveſtigation of which has employed the ingenuity of ſeveral phyſicians and naturaliſts of the preſent day †.

SECRET POISON.

UNDER this name are generally underſtood all poiſons, which can be adminiſtered imperceptibly, and which gradually ſhorten the life of man, like a lingering diſeaſe. They were not firſt diſcovered, in the laſt century, in France and Italy, as many believe; but were known to the ancient Greeks and Romans, by whom they were uſed. I

* Scalpella magica: Quidam ſunt qui dentiſcalpia auriſcalpiaque habent, quæ tactu ſolo dolores dentium, aurium et oculorum tollant; ego vero, cum certo acceperim eſſe tantum magnete tacta, id tibi revelare volui. *Petri Borelli Hiſt. et obſerv. medico-phyſic. Cent. iv.* Franc. et Lipſ. 1676. 8vo. Cent. 4. obſ. 75. p. 376.

† J. D. Reichel. Diſſert. de magnetiſmo in corpore humano; reſp. C. Ludwig. Lipſiæ 1772.

muſt,

muſt, however, allow that they were never prepared with more art, at any period, or in any country, or employed oftener and with more ſucceſs, than they were in theſe countries, and at that time. If it be true that they can be prepared in ſuch a manner as to occaſion death at a certain period previouſly determined, or as that the perſon to whom they are given will die within a certain time limited, it muſt be confeſſed that the ancient poiſoners have been far exceeded by the modern. But this advantage will be conſidered as ſcarcely poſſible, when one reflects upon the many variable circumſtances which have an influence on the operation of medicines and poiſon; and it has often happened, that a company have ſwallowed the ſame poiſon, at the ſame time, and in the ſame quantity, ſome of whom have died ſooner and ſome later, while ſome have ſurvived. Thus died pope Alexander VI. in the year 1503, and Ceſar Borgia recovered without any loſs of health, though, by the bottles being changed through miſtake, he drank of the poiſon that had been prepared for the other gueſts alone. At any rate, I am of opinion that the celebrated Tophania, when ſhe engaged to free wives from diſagreeable huſbands within ſtated weeks and days, muſt have had certain and very accurate information reſpecting their conſtitution and manner of living, or, as the phyſicians ſay, their idioſyncraſy.

Some

Some phyſicians have doubted reſpecting ſecret poiſon * ; and others have only denied that its effects can with certainty be regulated to a fixed time †. I agree in opinion with the latter ; but the former can be confuted by many examples both of ancient and modern times : for that the ancients were acquainted with this kind of poiſon, can be proved by the teſtimony of Plutarch, Quintilian, and other reſpectable authors. We are told by Plutarch, that a ſlow poiſon, which occaſioned heat, a cough, ſpitting of blood, a conſumption, and a weakneſs of intellect, was adminiſtered to Aratus of Sicyon ‡ ; and Quintilian, in his declamations, ſpeaks of this poiſon in ſuch a

* Heberdeen in *Neuem Hamburgiſchen magazine*, xvii. p. 219. I am convinced that many of the accounts we have of the extraordinary effects of poiſon are fabricated, like thoſe mentioned in *Frid. Hoffmanni Diſſert. de læſionibus externis, abortivis venenis ac philtris.* Francof. 1729, et recuſa Lipſ. 1755. That author, however, denies ſome which are true. It is, for example, certain that camphor and rue do not produce the effects aſcribed to them by Dioſcorides, Paulus Ægineta, and others ; but there are, without doubt, other ſubſtances which will produce theſe effects.

† Sennerti Inſtitut. medicinæ, ii. 2, 12. edit. Witteberg. 1767 4to. p. 279.

‡ He gave to Aratus a poiſon, not ſpeedy and violent, but of that kind which at firſt occaſions a ſlow heat in the body, with a weak cough, and then gradually brings on a conſumption—οὐκ ὀξὺ καὶ σφοδρὸν, ἀλλὰ τῶν θέρμας τε μαλακὰς το πρῶτον ἐν τῷ σώματι καὶ βῆχα κινούντων ἀμβλεῖαν, εἶτα οὕτως κατὰ μικρὸν εἰς φθορὰν περαινόντων. One time, when Aratus ſpat up blood, he ſaid, " This is the effect of " royal friendſhip." See *Plutarch. vit. Arati.* Baſil. 1533. p. 358.

manner

manner as proves that it muſt then have been well known *. It cannot be ſaid that ſuch an invention was too great for that period; or that it required a greater ſkill in chemiſtry than any one then poſſeſſed; for the Indians, in America, are acquainted with a moſt perfect poiſon of this kind, and can employ it with ſo much ſkill that the perſon to whom it is given cannot guard againſt the treachery, even with the utmoſt precaution; but infallibly dies, though in a lingering manner, often after the expiration of ſome years †.

Theophraſtus ſpeaks of a poiſon which could be moderated in ſuch a manner as to have effect in two or three months, or at the end of a year or two years; and he remarks that the death, the more lingering it was, became the more miſerable. This poiſon was prepared from aconitum, a plant which, on that account, people were forbidden to have in their poſſeſſion, under pain of capital pu-

* Venenum putabis quidquid dederint hæ manus. Et virus præſentaneum paro, quod ſtatim, quod ſubito corripiat? At quemadmodum mihi ſuperſit ulla defenſio? An lentum, et quod tarda peſte conſumat? ſcilicet, ut non ſtatim exclames, ut te meum virus bibiſſe non credas. *Quint. declamat.* xvii. 11. p. 341.

† With the poiſon of the Indians, however, the ancients could not be acquainted, as it is prepared from a plant not known in Europe before the diſcovery of America. Kalm, in his Travels, does not name it: and in that he has done right; for, as the plant is now to be found every where, no government could guard againſt a miſapplication of it, were it publicly known.

niſhment.

niſhment *. He relates alſo, that Thraſyas had diſcovered a method of preparing from other plants a poiſon which, given in ſmall doſes of a dram, occaſioned an eaſy but certain death, without any pain, and which could be kept back for a long time without cauſing weakneſs or corruption. This Thraſyas, whoſe ſcholar Alexias carried the art ſtill farther, was a native of Mantinea, a city in Arcadia †, and is celebrated by Theophraſtus on account of his abilities, and particularly his knowledge of botany; but thoſe are miſtaken who aſcribe to him the diſcovery of ſecret poiſon ‡.

This poiſon was much uſed at Rome about two hundred years before the Chriſtian æra. As ſeveral perſons of diſtinction died the ſame year at that period, and of the like diſtemper, an enquiry being made into the cauſe, a maid ſervant gave

* They ſay a poiſon can be prepared from aconite (aconitum) ſo as to occaſion death within a certain period, ſuch as two, three or ſix months, a year, and even ſometimes two years. Thoſe, we are told, whoſe conſtitutions are able to hold out longeſt die in the greateſt miſery; for the body is gradually conſumed, and muſt periſh by continual waſting. Thoſe die eaſieſt who die ſpeedily. No remedy has been found out for this poiſon. *Theophr. Hiſt. Plant.* ix. c. 16. p. 189.

† Of this Thraſyas and Alexias we know no more than what is to be found in *Fabricii Bibliotheca græca*, vol. xiii. p. 53 and 437. He remarks, that in Theophraſtus we muſt read Μαντινευς, inſtead of Μαντιευς.

‡ This is done in a work, collected without judgment, entitled *Nachricht von erfindungen und erfindern.* Hamburg 1707. 12. p. 154. The author of this work is, undoubtedly, Paul Jacob Marperger.

evidence

evidence againſt ſome ladies of the firſt families, who, ſhe ſaid, prepared and diſtributed poiſon; and above an hundred and fifty of them were convicted and puniſhed *. As ſo many had learned this deſtructive art, it could not be ſuppreſſed; and we find ſufficient proofs in the Roman hiſtory that it was continually preſerved. Sejanus cauſed ſuch a ſecret poiſon to be adminiſtered by a eunuch to Druſus, who gradually declined afterwards, as by a conſumptive diſorder, and at length died †. Aggripina being deſirous of getting rid of Claudius, but not daring to diſpatch him ſuddenly, and yet wiſhing not to leave him ſufficient time to make new regulations reſpecting the ſucceſſion to the throne, ſhe made choice of a poiſon which ſhould deprive him of his reaſon, and gradually conſume him. This ſhe cauſed to be prepared by an expert poiſoner, named Locuſta, who had been condemned to death for her infamous actions, but ſaved that ſhe might be employed as a ſtateengine. The poiſon was given to the emperor in a diſh of muſhrooms; but as, on account of his irregular manner of living, it did not produce the deſired effect, it was aſſiſted by ſome of a ſtronger nature ‡. This Locuſta prepared alſo the

* Neque de veneficiis ante eam diem Romæ quæſitum eſt. *Livius*, lib. viii. c. 18.

† Igitur Sejanus, maturandum ratus, deligit venenum quo paulatim irrepente fortuitus morbus adſimularetur. *Taciti Annal.* lib. iv. c. 8.

‡ The account given by Tacitus deſerves to be read: Tum Agrip-

the poiſon with which Nero diſpatched Britannicus, the ſon of Agrippina, whom his father Claudius wiſhed to ſucceed him on the throne. As this poiſon occaſioned only a dyſentery, and was too ſlow in its operation; the emperor compelled Locuſta by blows, and by threatening her with death, to prepare, in his preſence, one more powerful. It was firſt tried on a kid: but as the animal did not die till the end of five hours, ſhe boiled it a little longer, until it inſtantaneouſly killed a pig to which it had been given, and this poiſon diſ-

pina, ſceleris olim certa et oblatæ occaſionis propera, nec miniſtrorum egens, de genere veneni conſultavit; ne repentino et præcipiti facinus proderetur; ſilentum et tabidum delegiſſet, ne admotus ſupremis Claudius, et dolo intellecto, ad amorem filii rediret; exquiſitum placebat; quod turbaret mentem et mortem differret. Deligitur artifex talium vocabulo Locuſta, nuper veneficii damnata, et diu inter inſtrumenta regni habita. - - - Soluta alvus ſubveniſſe videbatur. Igitur exterrita Agrippina - - - Xenophontis medici conſcientiam adhibet. Ille, tanquam niſus evomentis adjuvaret, pinnam rapido veneno illitam faucibus ejus de miſiſſe creditur. J. C. W. Mohſen, in his excellent *Beſchreibung einer Berliniſchen medaillen-ſammlung*, part i. Berlin and Leipſic 1773, 4to. p. 261, is of opinion that Tacitus contradicts himſelf in his account: becauſe he ſays that Agrippina made choice of a ſlow poiſon; and, afterwards, that ſhe was ſurpriſed it had not operated more ſpeedily. But Agrippina wiſhed not only that Claudius might be deſtroyed ſlowly, but alſo, and principally, that he might be ſuddenly deprived of his underſtanding. As that, however, did not happen, and as ſhe had to apprehend both a change in the ſucceſſion to the throne, and a detection of the ſecret poiſon, ſhe bethought herſelf of one that was ſtronger. What Mr. Mohſen ſays in apology for Xenophon, I ſhall leave to the judgment of others. With me, the fidelity of the Roman hiſtorian has more weight than the integrity of the emperor's phyſician, who, notwithſtanding his love for his country, and the liberality and confidence of the emperor, may have been liable to waver.

patched

patched Britannicus as ſoon as he had taſted it *. For this ſervice the emperor pardoned Locuſta, rewarded her liberally, and gave her pupils whom ſhe was to inſtruct in her art, in order that it might not be loſt.

The art of preparing this poiſon muſt have been well underſtood alſo at Carthage. When M. Attilius Regulus, the Roman general, who had been taken by the Carthaginians, was ſent to Rome to propoſe to the ſenate that the Carthaginian priſoners might be reſtored in exchange for him, he prevented this negotiation, becauſe he knew that a poiſon had been adminiſtered to him by which the ſtate would ſoon be deprived of his

* The hiſtory of this horrid affair may be found both in Tacitus and Suetonius. From the former, I ſhall quote only the following words: Primum venenum ab ipſis educatoribus accepit, tranſmiſitque exſoluta alvo parum validum, ſive temperamentum inerat, ne ſtatim ſæviret. Sed Nero, lenti ſceleris impatiens, jubere ſupplicium veneficæ · · · Promittenti dein tam præcipitem necem quam ſi ferro urgeretur, cubiculum Cæſaris juxta decoquitur virus, cognitis antea venenis rapidum; · · · quod ita Britannici cunctos artus pervaſit, ut vox pariter et ſpiritus ejus raperentur. *Tacit. Annal.* xiii. c. 15, 16.

Suetonius ſays: Britannicum veneno aggreſſus eſt. Quod acceptum a quadam Locuſta, venenariorum indice, cum opinione tardius cederet, ventre modo Britannici moto; accerſitam mulierem ſua manu verberavit, arguens pro veneno remedium dediſſe. Excuſantemque minus datum ad occultandam facinoris invidiam, · · · coegit ſe coram in cubiculo quam poſſet velociſſimum ac præſentaneum coquere. Deinde in hædo expertus, poſtquam is quinque horas protraxit; iterum ac ſæpius recoctum, porcello objecit. Quo ſtatim exanimato, inferri in triclinium, darique cœnanti ſecum Britannico imperavit. Et cum ille ad primum guſtum concidiſſet · · · *Suet.* vi. c. 33. Reſpecting Locuſta, ſee alſo *Juvenal, ſat.* i. 1. 71.

ſervices. He returned, therefore, to Carthage, in compliance with the promiſe he had made to the enemy, who put him to death with the moſt exquiſite torture *.

All theſe poiſons were prepared from plants, particularly aconite, hemlock, and poppy, or extracted from animal ſubſtances. Among thoſe made from the latter, none is more remarkable than that ſupplied by the ſea-hare, lepus marinus, with which, as Philoſtratus ſays †, Titus was diſpatched by Domitian. Without here attempting to define the ſubſtances employed by the ancients to compoſe their poiſons, I ſhall only obſerve, that the *lepus marinus*, the terrible effects of which are expreſſly mentioned

* This account is given by Aulus Gellius, from the now loſt works of Tuditanus, who makes Regulus ſay: Venenum ſibi Carthaginenſes dediſſe non præſentarium, ſed ejuſmodi quod mortem in diem proferret; eo conſilio ut viveret quidem tantiſper quoad fieret permutatio; poſt autem graſſante ſenſim veneno cor tabeſceret. Cicero often ſpeaks of the magnanimity of Regulus, as for example in his Oration againſt Piſo, and in his Offices, book iii. chap. 27: but he makes no mention of his having been poiſoned. Regulus ſaid, Captivos adoleſcentes eſſe et bonos duces, ſe jam confectum ſenectute. Valerius Maximus, alſo, book i. chap. i. 14. ſays nothing of poiſon.

† Titum autem, cum poſt mortem patris annos duos regnaſſet, a marino lepore interfectum dicunt. Is autem piſcis humores quoſdam occultos habet mortiferos ſupra omnia venena quæ mari terrave naſcantur. Et Neronem hunc ipſum piſcem epulis miſcuiſſe quandoque tradunt adverſus homines ſibi inimiciſſimos. Domitianus quoque hoc eodem contra Titum fratrem uſus fuiſſe putatur, quod grave moleſtumque ſibi videretur ſimul cum fratre humano, benignoque viro imperare. *Apollonii Vit.* lib. vi. c. 14.

by

by Dioſcorides *, Galen, Nicander, Ætius †, Ælian ‡, Pliny ||, and others, is that animal called, at preſent, in the Linnean Syſtem, *aplyſia depilans* §, as Rondelet conjectured, and has been ſince fully proved by Bohadſch ¶. This animal poiſon, however, ſeems to have been ſeldom uſed, as it eaſily betrays itſelf by ſome peculiar ſymptoms. It appears that it was not known to Ariſtotle, at leaſt he makes no mention of it **. With the far ſtronger, and now common, mineral

* Lib. ii. c. 18. and vi. c. 30.

† Lib. xii.

‡ Hiſtor. Animal. lib. ii. c. 45.

|| Lib. ix. c. 48, and lib. xxxii. c. 1.

§ In *Syſtemate Nat.* through an error of the preſs, ſtands *Laplyſia*, which word has ſince become common. Απλυσια ſignifies an uncleanneſs which cannot be waſhed off; and in Ariſtotle's Hiſtory of Animals, b. v. ch. 15. and Pliny, b. ix. ch. 45. it is the name of a kind of muſhroom. In the like manner other errors, in the Syſtem of Linnæus, have been copied into the works of others, ſuch as *Dytiſcus* inſtead of *Dyticus*, &c.

¶ J. B. Bohadſch *de quibuſdam animalibus marinis*. Dreſdæ 1761. 4to. p. 1—53. In this work there is a full deſcription, with a figure, of this fiſh, under the name of Lernæa, which was uſed in the firſt editions of Linnæus.

** The accounts given by the ancients of the ſea-hare have been collected in *Jacobi Grevini lib. de venenis*, Antverpiæ 1571, p. 209. In the *Annals of Glycas*, iii. p. 185. the edition of Venice in 1729, fol. it is ſaid that Titus was diſpatched by this poiſon. In the firſt book, p. 27, Glycas ſays, ὁ λαγωὸς ὁ θάλασσιος ταχεῖαν καὶ ἀπαράιτητον τὴν Φθορὰν ἐπιφέρονται: The ſea hare occaſions ſpeedy and inevitable deſtruction to man. In Geſner's edition of Stephen's Lexicon, there is a double error, where *lepus marinus* is explained by *piſcis ex lacertorum genere*. So faulty are the beſt dictionaries, in regard to the appellations of naturaliſts.

poiſons the ancients were not acquainted; for their arſenic was what we call orpiment, and not that pernicious metallic calx which formed the principal ingredient of thoſe ſecret poiſons which, in latter times, were in France and Italy brought to a diabolical perfection *.

No one was ever more infamous by this art than Tophana, or Toffania, a woman who reſided firſt at Palermo, and afterwards at Naples. She ſold thoſe drops, which from her acquired the name of *aqua Tophania*, *aqua della Toffana*, and which were called alſo *acquetta di Napoli*, or only *acquetta*; but ſhe diſtributed her preparation by way of charity to ſuch wives as wiſhed to have other huſbands. From four to ſix drops were ſufficient to deſtroy a man; and it was aſſerted that the doſe could be ſo proportioned as to operate in a certain time. As

* See *C. G. Stenzelii Diſſ. de venenis terminatis et temporancis, quæ Galli* les poudres de ſucceſſion *vocant*; *reſp.* J. G. Arnold. Vitebergæ 1730. This work contains ſeveral hiſtorical relations; but the reader is often referred to authors who either do not ſay that for which they were quoted, or who muſt relate the ſame thing in a different manner in ſome other place. As for example, Galen in b. ii. c. 7. *de antidotis* ſpeaks of poiſons, without mentioning ſecret poiſon in particular. Avicenna is made to ſay, in his book *de viribus cordis*, that the Egyptian kings often employed this poiſon; but if by that quotation we are to underſtand *Fen. undecima de diſpoſitionibus cordis*, I have ſought for this information in vain. In lib. iv. fen. 6. tract. 2. c. 14. or according to the beautiful edition *Venetiis apud Juntas* 1608. 2 vol. fol. ii. p. 210. it is ſaid *Fel canis aquatici interficit poſt hebdomadam.* Rhodiginus alſo does not relate that for which he is quoted by Stenzel. p. 7.

ſhe

ſhe was watched by the government, ſhe fled to an eccleſiaſtical aſylum; and when Keyſler was at Naples in 1730, ſhe was then ſtill living, becauſe no one could, or was willing to, take away her life, while under that protection. At that time ſhe was viſited by many ſtrangers out of curioſity.

In Labat's travels through Italy * we alſo find ſome information which may ſerve, ſtill farther, to illuſtrate the hiſtory of Tophania. She diſtributed her poiſon in ſmall glaſs phials, with this inſcription, *Manna of St. Nicholas of Bari*, and ornamented with the image of the ſaint. A miraculous oil, employed by folly in the cure of many diſeaſes, drops from the tomb of that ſaint which is ſhewn at Bari, in the kingdom of Naples; and on this account it is diſperſed in great abundance under the like name. It was therefore the beſt appellation which Tophania could give to her poiſon, becauſe the reputed ſanctity of it prevented the cuſtom-houſe officers from examining it too cloſely. When the viceroy was informed of this, which I think was in 1709, Tophania fled from one convent to another, but was at length ſeized, and thrown into priſon. The clergy raiſed a loud outcry, on account of this violation of eccleſiaſtical freedom, and endeavoured to excite the people to inſurrection. But they were ſoon appeaſed, on a report being ſpread that Tophania had confeſſed

* Vol. iv. p. 33.

ſhe had poiſoned all the ſprings in the city. Being put to the rack, ſhe acknowledged her wickedneſs; named thoſe who had protected her, who were immediately dragged from churches and monaſteries; and declared that, the day before ſhe had abſconded, ſhe had ſent two boxes of her manna to Rome, where it was found in the cuſtom-houſe, but ſhe did not accuſe any one of having ordered it. She was afterwards ſtrangled, and, to mitigate the archbiſhop, her body was thrown, at night, into the area of the convent from which ſhe had been taken. Tophania, however, was not the only perſon at Naples who underſtood the making of this poiſon; for Keyſler ſays, that, at the time he was there, it was ſtill ſecretly prepared, and much employed *.

In the year 1659, under the government of pope Alexander VII, it was obſerved at Rome, that many young married women became widows, and that many huſbands died when they became diſagreeable to their wives. Several of the clergy declared alſo, that for ſome time paſt various perſons had acknowledged at confeſſion, that they had been guilty of poiſoning. As the government employed the utmoſt vigilance to diſcover theſe poiſoners, a ſociety of young wives, whoſe preſident appeared to be an old woman who pretended to foretell future events, and who had often predicted

* Keyſler's Fortſetzung neueſter reiſen. Hannover 1741. p. 234.

very

very exactly the death of many perſons, became ſuſpected. To convict her of the crime, a crafty woman, given out to be a perſon of conſiderable diſtinction, was ſent to her, who pretended that ſhe wiſhed to obtain her confidence, and to procure ſome of her drops for a cruel and tyrannical huſband. The whole ſociety were by this ſtratagem arreſted; and all of them, except the fortune-teller, whoſe name was Hieronyma Spara, confeſſed before they were put to the torture.—— "Where now," cried ſhe, "are the Roman "princes, knights and barons, who on ſo many "occaſions promiſed me their protection! Where "are the ladies who aſſured me of their friend-"ſhip! Where are my children whom I have "placed in ſo diſtinguiſhed ſituations!" In order to deter others from committing the like crime, one Gratioſa, Spara's aſſiſtant, three other women, and the obſtinate Spara herſelf, who ſtill entertained hopes of aſſiſtance till the laſt moment, were hanged in the preſence of innumerable ſpectators. Some months after, ſeveral more women were executed in the ſame manner; ſome were whipt, and others were baniſhed from the country. Notwithſtanding theſe puniſhments, the effects of this inveterate wickedneſs have been from time to time remarked. Le Bret, to whom we are indebted for the above account, ſays *, that Spara

* J. F. le Bret, Magazin zum gebrauche der ſtaaten-kirchengeſchichte, part iv. Francf. and Leipſ. 1774. 8vo. p. 131—141.

was a Sicilian, and acquired her knowledge from Tophania at Palermo. If that be true, the latter muſt have been early initiated in villany, and muſt have become when very young a teacher of her infamous art. Keyſler calls her a little old woman.

The art of poiſoning never excited more attention in France than about the year 1670 *. Mary Margaret d'Aubray, daughter of the lieutenant-civil Dreux d'Aubray, was, in the year 1651, married to the marquis de Brinvillier, ſon of Gobelin preſident of the Chamber of accounts, who had a yearly income of thirty thouſand livres, and to whom ſhe brought a portion of two hundred thouſand. He was meſtre de camp of the regiment of Normandy, and during the courſe of his campaigns became acquainted with one Godin de Sainte Croix †, a young man of a diſtinguiſhed family, who ſerved as a captain of cavalry in the regiment of Traſſy. This young officer, who was then a needy

* The following account is collected from Cauſes celèbres et intéreſſantes, par M. Guyot de Pitaval, tome i. à la Haye 1737. 8vo. p. 267—326. Recueil des lettres de Mad. la marquiſe de Sevigné. A Paris 1754. iv. p. 44—198. Hiſtoire du regne de Louis XIV, par M. de Reboulet. Avignon 1746. v. p. 159. Hiſtoire de la vie et du regne de Louis XIV, publiée par M. Bruzen de la Martiniere, à la Haye 1740. iv. p. 229. Le ſiecle de Louis XIV, par Voltaire. Berlin 1751. ii. p. 59. Mémoires et réflexions ſur les principaux evenemens du regne de Louis XIV, par M. L. M. D. L. F. A Rotterdam 1716. p. 209—214.

† In the account of Martiniere there are ſeveral errors: among theſe is, that he calls Godin, l'abbé *de la Croix*.

adventurer, became a conſtant viſitor of the marquis, and in a ſhort time paid his addreſſes to the marchioneſs, who loſt her huſband after ſhe had helped to diſſipate his large fortune, and was thus enabled to enjoy her amours in greater freedom. Her indecent conduct, however, gave ſo much uneaſineſs to her father, that he procured a lettre de cachet, had Sainte Croix arreſted, while in a carriage by her ſide, and thrown into the Baſtille *. Sainte Croix there got acquainted with an Italian named Exili, who underſtood the art of preparing poiſon, and from whom he learned it. As they were both ſet at liberty after a year's impriſonment, Sainte Croix kept Exili with him until he became perfectly maſter of the art, in which he afterwards inſtructed the marchioneſs, in order that ſhe might employ it in bettering the circumſtances of both. When ſhe had acquired the principles of the art, ſhe aſſumed the appearance of a nun, diſtributed food to the poor, nurſed the ſick in the Hôtel-Dieu, and gave them medicines, but only for the purpoſe of trying the ſtrength of her poiſon undetected on theſe helpleſs wretches †. It was ſaid in Paris, by way of ſatire, that no young phyſician, in introducing himſelf to practice, had ever ſo

* Voltaire ſays, that the father did not get Sainte Croix thrown into the Baſtille, but ſent to his regiment. This, however, is not the caſe; for this reprobate was at that time not in the army.

† This circumſtance is denied by Voltaire, but only, as appears, to contradict Pitaval, whom he calls *un avocat ſans cauſe*.

ſpeedily

ſpeedily filled a church-yard as Brinvillier. By the force of money, ſhe prevailed on Sainte Croix's ſervant, called La Chauſſée, to adminiſter poiſon to her father, into whoſe ſervice ſhe got him introduced, and alſo to her brother, who was a counſellor of the parliament, and reſided at his father's houſe. To the former the poiſon was given ten times before he died; the ſon died ſooner; but the daughter, mademoiſelle d'Aubray, the marchioneſs could not poiſon, becauſe, perhaps, ſhe was too much on her guard; for a ſuſpicion ſoon aroſe that the father and ſon had been poiſoned, and the bodies were opened. She would, however, have eſcaped, had not providence brought to light the villany.

Sainte Croix, when preparing poiſon, was accuſtomed to wear a glaſs maſk; but as this once happened to drop off by accident, he was ſuffocated, and found dead in his laboratory. Government cauſed the effects of this man, who had no family, to be examined, and a liſt of them to be made out. On ſearching them, there was found a ſmall box, to which Sainte Croix had affixed a written requeſt, that after his death it might be delivered to the marchioneſs de Brinvillier, or, in caſe ſhe ſhould not be living, that it might be burnt*. Nothing

* This requeſt was as follows: "I humbly beg that thoſe into "whoſe hands this box may fall, will do me the favour to deliver it "into the hands only of the marchioneſs de Brinvillier, who reſides in "the

Nothing could be a greater inducement to have it opened than this ſingular petition ; and that being done, there was found in it a great abundance of poiſons of every kind, with labels on which their effects, proved by experiments made on animals, were marked. When the marchioneſs heard of the death of her lover and inſtructor, ſhe was deſirous to have the caſket, and endeavoured to get poſſeſſion of it, by bribing the officers of juſtice ; but as ſhe failed in this, ſhe quitted the kingdom. La Chauſſée, however, continued at Paris, laid claim to the property of Sainte Croix, was ſeized and impriſoned, confeſſed more acts of villany than were ſuſpected, and was, in conſequence, broke alive on the wheel in 1673.

A very active officer of juſtice, named Deſgrais, was diſpatched in ſearch of the marchioneſs de Brinvillier, who was found in a convent at Liege, to which ſhe had fled from England. To entice her from this privileged place, which folly had

" the ſtreet Neuve Saint Paul, as every thing it contains concerns her,
" and belongs to her alone, and as, beſides, there is nothing in it that
" can be of uſe to any perſon except her ; and in caſe ſhe ſhall be dead
" before me, to burn it, and every thing it contains, without opening
" or altering any thing ; and, in order that no one may plead igno-
" rance, I ſwear by the God whom I adore, and by all that is moſt
" ſacred, that I advance nothing but what is true. And if my inten-
" tions, juſt and reaſonable as they are, be thwarted in this point,
" I charge their conſciences with it, both in this world and the next,
" in order that I may unload mine, proteſting that this is my laſt will.
" Done at Paris this 25th of May in the afternoon, 1672.

" DE SAINTE CROIX."

conſecrated

conſecrated for the protection of vice, Deſgrais aſſumed the dreſs of an abbé, found means to get acquainted with her, acted the part of a lover, and, having engaged her to go out on an excurſion of pleaſure, arreſted her. Among her effects at the convent, there was found a confeſſion, written by her own hand, which contained a complete catalogue of her crimes. She there acknowledged that ſhe had ſet fire to houſes, and that ſhe had occaſioned the death of more perſons than any one ever ſuſpected. She remarked alſo, that ſhe had continued a virgin only till the ſeventh year of her age. Notwithſtanding all the craft which ſhe employed to eſcape, ſhe was conveyed to Paris, where ſhe at firſt denied every thing; and, when in priſon, ſhe played piquet to paſs away the time. She was, however, convicted, brought to a confeſſion of her enormities, became a convert, as her confeſſor termed it, and went with much firmneſs to the place of execution, on the 16th of July, 1676; where, when ſhe beheld the multitude of the ſpectators, ſhe exclaimed in a contemptuous manner, "You have come to ſee a fine ſpectacle!" She was beheaded, and afterwards burned; a puniſhment too mild for ſuch an offender *. As ſhe had been amuſed with ſome hopes of a pardon, on ac-

* Martiniere ſays that ſhe was burned alive, together with all the papers reſpecting her trial. The latter is improbable, and the former certainly falſe, notwithſtanding the account given in the *Encyclopédie*.

count of her relations, when ſhe mounted the ſcaffold, ſhe cried out "*C'eſt donc tout de bon* * *!*"

Among a number of perſons ſuſpected of being concerned in this affair, was a German apothecary, named Glaſer, who, on account of his knowledge in chemiſtry, was intimate with Exili and Sainte Croix. From him they had both procured the materials which they uſed, and he was ſome years confined in the Baſtille; but the charge againſt him being more minutely inveſtigated, he was declared innocent, and ſet at liberty. He was the author of a treatiſe of chemiſtry, printed at Paris in 1667, and reprinted afterwards at Bruſſels in 1676, and at Lyons in 1679.

By the execution of this French Medea, the practice of poiſoning was not ſuppreſſed; many perſons died from time to time with very ſuſpicious circumſtances; and the archbiſhop was informed, from different pariſhes, that this crime was ſtill confeſſed, and that traces of it were remarked both in high and in low families. For

* The following deſcription of Brinvillier may perhaps be of uſe to our phyſiognomiſts: "In order to ſatisfy the curioſity of thoſe who "may be deſirous of knowing if ſuch a celebrated criminal partook of "the beauties of her ſex, I ſhall obſerve, that nature had not been "ſparing of them to the marchioneſs; her features were exceedingly "regular, and the form of her face, which was round, was very "graceful. This beautiful outſide concealed a heart extremely black. "Nothing proves more that *metopoſcopy*, or the ſcience of phyſiognomy, is falſe; for this lady had that ſerene and tranquil air which "announces virtue." *Pitaval*, p. 269.

watching,

watching, ſearching after, and puniſhing poiſoners, a particular court, called the *Chambre de poiſon*, or *Chambre ardente*, was at length eſtabliſhed in 1679. This court, beſides other perſons, detected two women, named La Vigoreux and La Voiſin *, who carried on a great traffic in poiſons. The latter was a midwife. Both of them pretended to foretell future events, to call up ghoſts, and to teach the art of finding hidden treaſures, and of recovering loſt or ſtolen goods. They alſo diſtributed philtres and ſold ſecret poiſon to ſuch perſons as they knew they could depend upon, and who wiſhed to employ them either to get rid of bad huſbands, or recover loſt lovers. Female curioſity induced ſeveral ladies of the firſt rank, and even belonging to the court, to viſit theſe women, particularly La Voiſin, and who, without thinking of poiſon, only wiſhed to know how ſoon a huſband, lover, the king or his miſtreſs, would die. In the poſſeſſion of La Voiſin was found a liſt of all thoſe who had given themſelves up to her impoſition, who were arreſted and carried before the above-mentioned court, which, without following the uſual courſe of juſtice, detected ſecret crimes by means of ſpies, tried them privately, and began to imitate the proceedings of the holy inquiſition. In this liſt

* Some information reſpecting La Voiſin may be found in *Lettres hiſtoriques et galantes par Madame de C——*. A Cologne 1709—1711. 4 vols. 12mo. ii. p. 101. and iv. p. 376. The authoreſs of theſe letters was Mad. du Noyer.

were found the diſtinguiſhed names of the counteſs of Soiſſons, her ſiſter the ducheſs de Bouillon, and marſhal de Luxembourg. The firſt fled to Flanders to avoid the ſeverity and diſgrace of imprisonment; the ſecond ſaved herſelf by the help of her friends; and the laſt, after he had been ſome months in the Baſtille, and had undergone a ſtrict examination, by which he almoſt loſt his reputation, was ſet at liberty as innocent. Thus did the cruel Louvois, the war miniſter, and the marchioneſs de Monteſpan, ruin thoſe who oppoſed their meaſures. La Vigoreux and La Voiſin were burnt alive, on the 22d of February 1680, after their hands had been bored through with a red hot iron, and cut off. Several perſons of ordinary rank were puniſhed by the common hangman; thoſe of higher rank, after they had been declared by this tribunal not guilty, were ſet at liberty; and in 1680 an end was put to the *Chambre ardente*, which in reality was a political inquiſition.

It is certain that, notwithſtanding ſuch puniſhments, like crimes have given occaſion to unjuſt ſucceſſion both in Italy and in France, and that attempts have been made for the ſame purpoſe even in the northern kingdoms. It is known, that in Denmark count Corfitz de Ulfeld was guilty, though it was not proved, of having intended to give the king a poiſon, which ſhould gradually deſtroy him like a lethargy *. Charles

* Leben des Grafen von Ulfeld, von H. P. aus dem Daniſchen überſetzt. Copenhagen und Leipzig 1775. 8vo. p. 220.

XI,

XI, alſo, king of Sweden, died by the effects of ſuch a poiſon. Having ruined ſeveral noble families by ſeizing on their property, and having after that made a journey to Torneo, he fell into a conſumptive diſorder, which no medicine could cure. One day he aſked his phyſician, in a very earneſt manner, what was the cauſe of his illneſs? The phyſician replied, "Your majeſty has been "loaded with too many maledictions." "Yes," returned the king, "I wiſh to God that the reduc- "tion of the nobility's eſtates had not taken place, "and that I had never undertaken a journey to "Torneo!" After his death his inteſtines were found to be full of ſmall ulcers *.

The oftener poiſoning in this manner happens, the more it is to be wiſhed that preventatives and antidotes were found out, and that the ſymptoms were aſcertained; but this is hardly poſſible as long as it is not known of what the poiſon properly conſiſts. Governments, however, have wiſely endeavoured to conceal the receipts, by ſuppreſſing the criminal procedures. Pope Alexander VII cauſed them to be ſhut up in the caſtle of St. Angelo; in France, it is ſaid, they were burned together with the criminals; in Naples only, the ſame precaution was not taken. I do not know that obſervations on the bodies of perſons

* This anecdote was told to me by the celebrated Linnæus. An account of what appeared on opening the body of this prince may be ſeen in *Baldingers Neuem magazin für ærzte*, vol. i. p. 91.

deſtroyed

deſtroyed by ſlow poiſon have been ever publiſhed; for what Pitaval ſays on that ſubject is not ſufficient *. People talk of powders and pills, but the greater part of this kind of poiſon appears to be a clear inſipid water, and that prepared by Toffania never once betrayed itſelf by any particular effects on the body. The ſale of aqua fortis was a long time forbidden at Rome, becauſe it was conſidered as the principal ingredient; but that is very improbable. At Paris it was once believed that ſucceſſion powder conſiſted of diamond duſt pounded exceedingly fine. Without aſſenting to this idea, one may contradict Voltaire, who conceives that diamond duſt is not more prejudicial than powder of coral. It may be rather compared to that fine ſand which is rubbed off from our mill-ſtones, and which we would conſider and guard againſt, as a ſecret poiſon, were we not highly negligent and careleſs of our health

* The lieutenant-civil continued ſtill to grow worſe. After having languiſhed a long time, being ſeized with a loathing of every kind of food preſented to him; his vomitings ſtill continuing, and nature being at length exhauſted, he expired without any fever. The three laſt days he had waſted very much; he was become extremely ſhrunk, and he felt a great heat in his ſtomach. When opened, that part and the duodenum were found to be black, and ſloughing off in pieces; the liver was mortified, and as it were burned. The counſellor was ill three months, had the like ſymptoms as the lieutenant-civil, and died in the ſame manner. When opened, his ſtomach and liver were found in a ſimilar ſtate. Pages 274, 275.

in the uſe of food *. In the caſket of Sainte Croix were found ſublimate, opium, regulus of antimony, vitriol; and a large quantity of poiſon ready prepared, the principal ingredients of which the phyſicians were not able to diſtinguiſh. Many have affirmed, that ſugar of lead was the chief ingredient †; but the conſequences of the poiſon did not ſeem to indicate the uſe of that metal. For ſome years paſt a harmleſs plant, which is only ſomewhat bitter and aſtringent, the *cymbalaria*, that grows on old walls ‡, has been loaded with the opprobrium of producing

* In one year a ton of ſand, at leaſt, which is baked with the flour, is rubbed off from a pair of mill-ſtones. If a mill grinds only 4385 buſhels annually, and one allows no more than twelve buſhels to one man, a perſon ſwallows in a year above ſix pounds, and in a month half a pound of pulveriſed ſand-ſtone, which, in the courſe of a long life, will amount to upwards of three hundred weight. Is not this ſufficient to make governments more attentive to this circumſtance?

† For the following important information I am indebted to profeſſor Baldinger. It is to be found in *Chriſtiani Henrici Erndl Diſſert. de veneno ſalutem ſiſtens*; *reſp. T. Taut.* Lipſiæ 1701. § 21. "There is "no doubt that the ſlow poiſon of the French and Italians, commonly "called ſucceſſion powder *(poudre de la ſucceſſion)*, owes its origin to "ſugar of lead. I know a chemiſt, who ſuperintends the laboratory "of a certain prince on the confines of Bohemia, and who by the orders "(perhaps not very laudable) of his patron has ſpent much time and "labour in ſtrengthening and moderating poiſons. He has often de-"clared, that of ſugar of lead, with the addition of ſome more volatile "corroſive, a very ſlow poiſon could be prepared, which, if ſwallowed "by a dog or other animal, would inſenſibly deſtroy it, without "any violent ſymptoms, in the courſe of ſome weeks or months."

‡ Antirrhinum cymbalaria. See *Onomatologia medica completa.* Ulm 1755. 8vo. article *Cymbalaria.*

this

this ſlow poiſon, while at the ſame time it has been celebrated by others on account of its medicinal properties * ; but it is, perhaps, not powerful enough to do either miſchief or good ; and it is probable that it has been added to poiſons either through ignorance, or to conceal other ingredients ; for the emperor Charles VI. who was king of the Two Sicilies atthe time when Toffania was arreſted, told his phyſician Garelli, who communicated the ſame in a letter † to the celebrated Hoffman, in 1718 or 1719, that the poiſon of that Italian Circe was compoſed of an arſenical calx, diſſolved in *aqua cymbalariæ*, and which I ſuppoſe was rendered ſtronger and more difficult to be detected by a ſalt that may be readily gueſſed. It is dreadful to think, that this ſecret poiſon is ad-

* J. J. Wepſeri Hiſtoria cicutæ aquaticæ. Adjectæ ſunt diſſertationes de thea helvetica ac cymbalaria ; cum [illegible] T. Zwingero. Lugd. Bat. 1733. 8vo.

† "Garelli, the emperor's principal phyſician, lately wrote to me ſomething remarkable in the following words :—" Your elegant diſſertation on the errors reſpecting poiſons brought to my recollection a certain ſlow poiſon, which that infamous poiſoner, ſtill alive in priſon at Naples, employed to the deſtruction of upwards of ſix hundred perſons. It was nothing elſe than cryſtalliſed arſenic, diſſolved in a large quantity of water by decoction, with the addition, but for what purpoſe I know not, of the herb *cymbalaria*. This was communicated to me by his imperial majeſty himſelf, to whom the judicial procedure, confirmed by the confeſſion of the criminal, was tranſmitted. This water, in the Neapolitan dialect, is called *aqua de Toffana*. It is certain death, and many have fallen a ſacrifice to it." *Fred. Hoffmanni Medicinæ rationalis ſyſtematicæ tomus ſecundus*. Halæ 1729. 4to. p. ii. c. 2. § 19. p. 185.

miniſtered as a febrifuge by ignorant or unprincipled phyſicians, quacks, and old women. It drives off obſtinate fevers, it is true; but it is equally certain that it haſtens death: it is, therefore a cure, which is far worſe than the diſeaſe, and againſt which governments and phyſicians cannot exclaim too ſeverely. Let me here be permitted to recommend to the latter the ideas of Mr. Mohſen on this ſubject *, and to chemiſts the means Mr. Bell employed to analyſe theſe ſtygian drops †. It was remarked at Rome, by accident, that lemon juice and the acid of lemons are, in ſome meaſure, counter-poiſons; and a phyſician named Paul Branchaletti, reſpecting whom I can find no information, wrote a book expreſsly on this antidote to theſe drops, according to the account of Keyſler, who however adds, "Every thing hitherto found out, ſuppoſes that one has taken the drops only for a ſhort time, or that one has had an opportunity to be upon one's guard when ſuſpicious circumſtances occurred, and to diſcover the threatened danger."

It ſeems to be almoſt certain that the poiſons prepared by Toffania and Brinvillier were arſenical mixtures, or, as Dr. Hahneman ‡ rightly con-

* Beſchreibung einer medaillen-ſammlung, i. p. 148.

† The ſame, p. 186. Of the internal uſe of arſenic, ſee *Baldingers Neues magazin für aerzte*, ii. p. 418.

‡ Ueber die Arſenikvergiftung, ihre hülfe, und gerichtliche aufmittelung. Leipſ. 1786. 8vo. p. 35.

jectures,

jectures, arſenical neutral ſalts. Loſs of appetite, faintneſs, gnawing pains in the ſtomach, loſs of ſtrength without any viſible cauſe, a continual indiſpoſition, followed by a waſting of the lungs, a ſlow fever, &c. are all ſymptoms which ſeem to announce that dangerous ſemi-metal. The opinion, however, that it was compoſed of opium and cantharides has, in latter times, received ſo many confirmations, that one is almoſt induced to believe that there are more kinds than one of this ſtygian water. The information given by the abbé Gagliani ſeems to carry too much weight with it to be denied *. It is confirmed alſo by Mr.

* On the 20th of December, 1765, died the dauphin, father of the preſent king, and in 1767 died the dauphin. It was a public report that they were both diſpatched by ſecret poiſon: and the gradual decline of their health, the other circumſtances which accompanied their illneſs, and the cabals which then exiſted at court, make this at leaſt not improbable. Many private anecdotes reſpecting theſe events may be found in a book entitled *L'Eſpion devaliſé. Feliciter audax.* London 1782. In page 61 it is ſaid, that on account of the ſuſpicions then entertained, it was wiſhed that information might be procured reſpecting ſecret poiſon, and the methods of preparing it; and that the abbé Gagliani, well known as a writer, has given the following:—"It is certain that in Europe the preparation of theſe drugs renders them pernicious and mortal. For example, at Naples the mixture of opium and cantharides, in known doſes, is a ſlow poiſon, the ſureſt of all, and the more infallible as one cannot miſtruſt it. At firſt it is given in ſmall doſes, that its effects may be inſenſible. In Italy we call it *aqua di Tufania*, Tufania water. No one can avoid its attacks, becauſe the liquor obtained from that compoſition is as limpid as rock water, and without taſte. Its effects are ſlow and almoſt imperceptible: a few drops of it only are poured into tea, chocolate, or ſoup, &c. There is not a

Mr. Archenholz *; but what he ſays of the uſe made of Spaniſh flies, by the Chineſe, to invigorate the ſixth ſenſe, gives reaſon to ſuſpect that his voucher is *L'Eſpion dévaliſé*, to whom the abbé Gagliani aſcribes the ſame words. It appears to me, however, if I may be allowed to judge from

lady at Naples who has not ſome of it lying carelefsly on her toilette with her ſmelling-bottles. She alone knows the phial, and can diſtinguiſh it. Even the waiting woman, who is her confidante, is not in the ſecret, and takes this phial for diſtilled water, or water obtained by precipitation, which is the pureſt, and which is uſed to moderate perfumes when they are too ſtrong.

"The effects of this poiſon are very ſimple. A general indiſpoſition is at firſt felt in the whole frame. The phyſician examines you, and perceiving no ſymptoms of diſeaſe, either external or internal, no obſtructions, no collection of humours, no inflammations, orders detergents, regimen and evacuation. The doſe of poiſon is then doubled, and the ſame indiſpoſition continues without being more characteriſed. —The phyſician, who can ſee in this nothing extraordinary, aſcribes the ſtate of the patient to viſcous and peccant humours, which have not been ſufficiently carried off by the firſt evacuation. He orders a ſecond —a third doſe—a third evacuation—a fourth doſe. The phyſician then ſees that the diſeaſe has eſcaped him, that he has miſtaken it, and that the cauſe of it cannot be diſcovered but by changing the regimen. He orders the waters, &c. In a word, the noble parts loſe their tone, become relaxed and affected, and the lungs particularly, as the moſt delicate of all, and one of thoſe moſt employed in the functions of the animal œconomy. The firſt illneſs then carries you off; becauſe the critical accumulation ſettles always on the weak part, and conſequently on the lobes of the lungs; the pus there fixes itſelf, and the diſeaſe becomes incurable. By this method they follow one as long as they chooſe for months, and for years. Robuſt conſtitutions reſiſt a long time. In ſhort, it is not the liquor alone that kills, it is rather the different remedies, which alter and then deſtroy the temperament, exhauſt the ſtrength, extenuate and render one incapable of ſupporting the firſt indiſpoſition that comes."

* England und Italien. ii. p. 354.

 probabilities,

probabilities, that the poiſon known in the Eaſt Indies under the name of *powſt*, is alſo water which has ſtood a night over the juice of poppies. It is given in the morning faſting to thoſe perſons, and particularly princes, whom people wiſh to diſpatch privately, and without much violence. It conſumes them ſlowly, ſo that they at length loſe all their ſtrength and underſtanding, and in the end die torpid and inſenſible *.

WOODEN BELLOWS.

AFTER the diſcovery of fire, the firſt inſtrument employed to blow it, and ſtrengthen it, has, undoubtedly, been a hollow reed, until the art was found out of forming a ſtick into a pipe by boring it. Our common bellows, which conſiſt of two boards joined together by a piece of leather, and which probably are an imitation of the lungs, appear to have been early known to the Greeks. I have, however, met with no paſſage in any ancient author from which I could learn the oldeſt conſtruction of this machine, which in latter times has received many improvements. Had I found ſuch information, I ſhould have endeavoured to explain it, as it would have contributed to enlarge the

* Univerſal Hiſtory, xxiii. p. 299. 323.—The information contained there is taken from Fraſer's Hiſtory of Nadir Shaw. Aurengzebe alſo cauſed one of his ſons to be put to death by this poiſon.

knowledge we have of the metallurgy of the ancients.

It may be remarked on the following lines of Virgil,

——— Alii taurinis follibus auras
Accipiunt, reddunque *———

that bull's leather is unfit for bellows, and that ox or cow leather only can be uſed for that purpoſe †; but accuracy is not to be expected in a poet; and beſides, Virgil is not the only author who employs the expreſſion *folles taurinos*; for Plautus ſays alſo; *Quam folles taurini habent, cum liqueſcunt petræ, ferrum ubi fit* ‡.

Strabo § tells us, from an old hiſtorian, that Anacharſis, the Scythian philoſopher, who lived in the time of Solon, invented the bellows, the anchor, and the potter's wheel: but this account is very doubtful, as Pliny, Seneca ||, Diogenes Laertius ¶, and Suidas, who likewiſe ſpeak of the inventions aſcribed to that philoſopher, mention only the two laſt, and not the bellows: beſides, Strabo himſelf remarks that the potter's wheel is noticed in Homer, and this poet is certainly older than Anacharſis. The latter, perhaps, became acquainted with that uſeful inſtrument during the courſe of his travels: and, on his return,

* Georg. iv. 170.

† Though this requires no confirmation, I ſhall here add the teſtimony of Agricola: Corium eſt bubulum vel equinum; ſed bubulum longe multumque præſtat equino. *De re metall.* lib. ix. p. 294.

‡ In Fragmentis. § Lib. vii. || Epiſt. 90. ¶ Lib. i. 8.

made

made his countrymen firſt acquainted with it. However this may be, it is well known that the perſon who introduces a foreign invention among a people, is often conſidered as the author of it.

In the oldeſt melting houſes the bellows were worked by men. Refuſe, therefore, and other remains of metal are found in places where, at preſent, no works would be erected, on account of the want of water.

Bellows made with leather, of which I have hitherto ſpoken, are attended with many inconveniences. They require careful management; are expenſive in their repairs; and beſides laſt often not more than ſix or ſeven years. If thin leather is employed, it ſuffers a great deal of the air to eſcape through it: an evil which muſt be guarded againſt by continually beſmearing it with train-oil, or other fat ſubſtances; and this is even neceſſary when thick leather is uſed, to prevent it from cracking in the folds. Damage by fire and water muſt alſo be avoided; and every time they are repaired, the leather muſt be again ſoftened with oil, which occaſions a conſiderable loſs of time.

In wooden bellows theſe inconveniences are partly leſſened, and partly remedied. As theſe bellows, except the pipe, conſiſt entirely of wood, many, who are not acquainted with the conſtruction of them, can hardly conceive the poſſibility of making ſuch a machine. Though they cannot be properly deſcribed without a figure, I ſhall endeavour

vour to give the reader ſome idea of them by the following ſhort ſketch. The whole machine conſiſts of two boxes placed the one upon the other, the uppermoſt of which can be moved up and down upon the lower one, in the ſame manner as the lid of a ſnuff-box, which has a hinge, moves up and down when it is opened or ſhut; but the ſides of the uppermoſt box are ſo broad as to contain the lower one between them, when it is raiſed to its utmoſt extent. Both boxes are bound together, at the ſmalleſt end, where the pipe is, by a ſtrong iron bolt. It may be readily comprehended, that when both boxes fit each other exactly, and the upper one is raiſed over the under one, which is in a ſtate of reſt, the ſpace contained by both will be increaſed; and conſequently more air will ruſh in through the valve in the bottom of the lower one: and when the upper box is again forced down, this air will be expelled through the pipe. The only difficulty is to prevent the air, which forces its way in, from eſcaping any where elſe than through the pipe; for it is not to be expected that the boxes will fit each other ſo cloſely as to prevent entirely the air from making its way between them. This difficulty, however, is obviated by the following ſimple and ingenious method. On the inner ſides of the uppermoſt box there are placed moveable ſlips of wood, which, by means of metal ſprings, are preſſed to the ſides of the other box, and fill up the ſpace between them. As

theſe

theſe long ſlips of wood might not be ſufficiently pliable to ſuffer themſelves to be preſſed cloſe enough; and as, though planed perfectly ſtraight at firſt, they would, in time, become warped in various directions, inciſions are made in them acroſs through their whole length, at the diſtance of from fifteen to eighteen inches from each other, ſo as to leave only a ſmall ſpace in their thickneſs, by which means they acquire ſufficient pliability to be every where preſſed cloſe enough to the ſides *.

The advantages of theſe wooden bellows are very great. When made of clean fir wood without knots, they will laſt thirty or forty years, and even longer, though continually kept in action forty-ſix or forty-eight weeks every year: nay, Polhem aſſures us that, when properly made, they will laſt a century. The effect produced by them is ſtronger, as well as more uniform, and can be moderated according to circumſtances. They are worked alſo with greater facility. The ſlips of wood on their ſides are apt to become damaged; but they can ſoon and eaſily be repaired. Every three or four months, however, the outer ſides only of the

* A complete deſcription and a figure of theſe bellows may be found in *Schluters Unterricht von hütten-werken*. Brunſwick 1738. fol. p. 51; in *Cramers Anfangsgründe der metallurgie*. Blankenburg and Quidlingburg 1777. fol. iii. p. 59; *Mémoires ſur l'art de fabriquer le fer, par Grignon*. Paris 1775. 4to. p. 199; *Traité de la fonte des mines par le feu du charbon de terre*; par M. de Genſſane. Paris 1770. 2 vol. 4to. i. p. 96; *Pini de venarum metallicarum excoctione*. Vindobonæ 1780. 4to. vol. i. p. 107.

inner

inner box, and the bolt which keeps the boxes together, muſt be ſmeared with oil. If we reckon up the price of ſuch bellows and the yearly expence, they will, according to Grignon's account, be only a fifth part of thoſe of the old leather bellows.

That the invention of theſe wooden bellows belongs to the Germans, is certain. Grignon* expreſsly affirms ſo; and in Becher's † time they were to be found in Germany, but not in England. Genſſane, who aſcribes the invention to the Swiſs, is certainly miſtaken; and perhaps he was led into this error, becauſe theſe bellows were firſt made known in France by a Swiſs. I cannot, however, aſcertain the name of the real inventor. In the middle of the ſixteenth century lived at Nuremberg an artiſt called Hans Lobſinger, who, in the year 1550, gave to the magiſtrates of that city a catalogue of his machines. From this catalogue Doppelmayer concludes that he underſtood the art of making ſmall and large bellows without leather, and entirely of wood, which could be uſed in melting-houſes and for organs, and likewiſe copper bellows that al-

* Germany is the country of machines. In general the Germans leſſen manual labour conſiderably by machines adapted to every kind of movement; not that we are deſtitute of able mechanics; we have the talent of bringing to perfection the machines invented by our neighbours. P. 200.

† Bechers Narriſche weiſheit und weiſe narrheit. Frankfort 1683. 12mo. p. 113.

ways

ways emitted a like degree of wind. As Lobſinger made organs, he, perhaps, fell upon this invention: but in what it actually conſiſted, or whether it might not die with him, I have not been able to learn. Agricola, who died in the year 1555, makes no mention of wooden bellows.

Samuel Reyher, formerly profeſſor at Kiel, in a diſſertation on air *, printed there in 1669, tells us, that about forty years before that period, two brothers, Martin and Nicholas Schelhorn, millers at the village of Schmalebuche in Cobourg, firſt invented wooden bellows. Both the brothers, he ſays, kept the invention ſecret, though he thinks they did not conceal it ſo cloſely as to prevent its being gueſſed at; and he relates alſo how he himſelf formed an idea of it †.

* In this diſſertation, the time of the invention is ſtated to be about forty years before, which would be the year 1629 or 1630; but in an improved edition, printed with additions at Hamburg, in 1725, and entitled *De pneumatica, ſive De aere et aerometria*, a different period is given. "About eighty years ago," ſays the author, "a new kind of bel-" lows, which ought rather to be called the pneumatic cheſts, was in-" vented in the village of Schmalebuche, in the principality of Co-" bourg, in Franconia. Two brothers, millers in that village, Martin " and Nicholas Schelhorn, by means of ſome box made by them, the lid " of which fitted very exactly, found out theſe cheſts, as I was told by " one of their friends, a man worthy of credit. Theſe cheſts are not of " leather, but entirely of wood joined together with iron nails. In " blackſmiths' ſhops they are preferred to thoſe conſtructed with lea-" ther, becauſe they emit a ſtronger blaſt, as leather ſuffers the more " ſubtle part of the air to eſcape through its pores."

† In many places theſe bellows were at firſt put in a wooden caſe, to prevent their conſtruction from being known.

To

To theſe bellows Schluter has aſſigned a much nobler inventor, who, perhaps, was the firſt perſon who made them known by a deſcription. He ſays expreſſly that they were invented by a biſhop of Bamberg *: but of this I have been able to find no confirmation; and I am inclined to aſcribe that ſervice rather to an organ builder, or a miller, than to a biſhop. According to Schluter's account, theſe bellows were employed ſo early as the year 1620, in the foreſt of Harze, to which they were firſt brought by ſome people from Bamberg. What Calvor ſays reſpecting the introduction of theſe bellows into the foreſt of Harze is much more probable: that in the year 1621 Lewis Pfannenſchmid, from Thuringia, ſettled at Oſtfeld near Goſlar, and began to make wooden bellows. The bellows-makers of that place conſpired therefore againſt him, and ſwore they would put him to death; but he was protected by the government. He would diſcloſe his art to no one but his ſon, who, as well as his grandſon a few years ago, had the making of all the bellows in the foreſt.

We are told by French authors, that the art of making theſe bellows was introduced into France, particularly into Berry, Nivernois and Franche Comté, by a German.

* In *J. P. Ludewig, Scriptores rerum epiſcopatus Bambergenſis.* Francofurti et Lipſiæ 1718. fol. Where any biſhop of latter times is praiſed, I find no mention of this uſeful and ingenious invention.

COACHES.

COACHES.

IF by this name we are to underſtand every kind of covered carriage, in which one can with convenience travel, there is no doubt that ſome of them were known to the ancients. The *arcera*, of which mention is made in the twelve tables, was a covered carriage uſed by ſick and infirm perſons *. It appears to have been employed earlier than the ſoft *lectica*, and by it to have been brought into diſuſe. A later invention is the *carpentum*, the form of which may be ſeen on antique coins, where it is repreſented as a two-wheeled car, with an arched covering, and which was ſometimes hung with coſtly cloth †. Still later were introduced the *carrucæ*, firſt mentioned by Pliny; but ſo little is known of them that antiquaries are uncertain whether they had only one wheel, like our wheel-barrows, or, as is more probable, four wheels ‡. This much, however, is known, that they were firſt-rate vehicles, ornamented with gold and precious

* Arcera vocabatur plauſtrum tectum undique et munitum, quaſi arca quædam magna veſtimentis inſtrata, qua nimis ægri aut ſenes portari cubantes ſolebant. See Leges XII tabularum illuſtratæ a J. N. Funccio. Rintelii 1744. 4to. p. 72. Gellius, xx. 1.

† Scheffer de re vehiculari, in Utriuſque theſauri antiquitatum nova ſupplementa congeſta a Poleno. Venetiis 1737, fol. v. p. 1380. Spanhem. de præſtant. numiſmatum Amſt. 1671. 4to. p. 613. Propertius, iv. 8. 23. mentions *ferica carpenta*.

‡ Scheffer l. c. p. 1472.

ſtones,

ſtones, and that the Romans conſidered it as an honour to ride in thoſe that were remarkably high *. In the Theodoſian code the uſe of them is not only allowed to civil and military officers of the firſt rank, but commanded as a mark of their dignity †.

After this, covered carriages ſeem more and more to have become appendages of Roman pomp and magnificence; but the manner of thinking which prevailed under the feudal ſyſtem baniſhed the uſe of them, for ſome time. As it was of the greateſt importance to the feudal lords that their vaſſals ſhould be always able to ſerve them on horſeback, they could not think of indulging them with elegant carriages. They foreſaw, that by ſuch luxury the nobility would give over riding on horſeback, and become much more indolent, and leſs fit for military ſervice. Maſters and ſervants, huſbands and wives, clergy and laity, all rode upon horſes or mules, and ſometimes women and monks more commodiouſly upon ſhe-aſſes. The miniſter rode to court; and the horſe, without any conductor, returned alone to his ſtable, till a ſervant carried him back to court to fetch his maſter ‡.

* Alii ſummum decus in carrucis ſolito altioribus ponunt. In my opinion the height here alluded to is to be underſtood that of the body; rather than that of the wheels, as ſome think.

† Omnes honorati, ſeu civilium ſeu militarium, vehiculis dignitatis ſuæ, id eſt carrucis, intra urbem ſacratiſſimi nominis ſemper utantur. *Codex Theodoſ.* lib. xiv. tit. 12. and *Cod. Juſtin.* lib. xi. tit. 19.

‡ C. A. Geutebruck, Gedanken und anmerkungen über die einrichtung einer kammer-verwaltung. Erfurt 1765. 8vo. p. 11.

In

In this manner rode the magiſtrates of the imperial cities to council, in the beginning of the ſixteenth century; ſo that, in the year 1502, ſteps to aſſiſt in mounting were erected by the Roman gate at Francfort *. The members of the council, who, at the diet, and on other occaſions, were employed as ambaſſadors, were, on this account, called *rittmeiſter* †; and even at preſent the expreſſion *riding ſervant* is preſerved in ſome of the imperial cities. The public entry of great lords into any place, or their departure from it, was never in a carriage, but on horſeback; and in all the works which ſpeak of the papal ceremonies, there is no mention of a ſtate coach, or body coachman, but of ſtate horſes, or ſtate mules. It was neceſſary that a horſe for his holineſs ſhould be of a grey colour, not mettleſome, however, but a quiet tractable nag; that a ſtool with three ſteps ſhould be brought to aſſiſt him to mount, and the emperor and kings, if preſent, were obliged to hold his ſtirrup, and to lead the horſe ‡, &c. Biſhops made their public entrance on horſes or aſſes richly decorated §. At the coronation of the emperor,

* Lerſner, Chronica der Stadt Frankfurt. i. p. 23.

† Lehmanns Chronica der Stadt Speier. Frankfurt 1698. fol. p. 618.

‡ Sacrarum cæremoniarum Romanæ eccleſiæ libri tres, auctore J. Catalano. Romæ 1750. 2 vol. fol. i. p. 131.

§ See J. P. Ludewigs Gelehrte anzeigen, welche vormals den Wochentlichen Halliſchen Anzeigen einverleibt worden, nunmehro aber zuſammen gedruckt. Halle 1743. 3 vol. 4to. i. p. 426. where the fol-

peror, the electors and principal officers of the empire were ordered to make their entrance on horſes, and to perform their ſervice on horſeback *. Formerly it was neceſſary that thoſe who received an inveſtiture ſhould make their appearance on horſeback: the vaſſal was obliged to ride with two attendants to his lord's court, where, having diſmounted from his horſe, he received his fief.

Covered carriages were known in the beginning of the ſixteenth century; but they were uſed only by women of the firſt rank, for the men thought it diſgraceful to ride in them. At that period, when the electors and princes did not chooſe to be preſent at the meetings of the ſtates, they excuſed themſelves by informing the emperor that their health would not permit them to ride on horſeback; and it was conſidered as a point eſtabliſhed, that it was unbecoming for them to ride like women †. What, according to the then prevailing ideas, was not allowed to princes, was much leſs permitted to their ſervants. In the year 1544, when count Wolf of Barby, was ſummoned by John Frederic, elector of Saxony, to go to Spires to attend the convention of the ſtates aſſembled there, he requeſted leave, on account of his ill ſtate of health,

lowing paſſage is quoted from *Ceremoniale Epiſcoporum*, lib. i. c. 11. Epiſcopus aſcendet mulam ornatam pontificalibus ephippiis et ſtragula violacei coloris, ac ita equitabit.

* Ludewigs Erläuter. der Guldenen Bulle. Franc. 1719. 2 vol. 4to. i p. 569.

† Von Ludolf, Electa juris publici, v. p. 417.

to

to make uſe of a cloſe carriage with four horſes. When the counts and nobility were invited to the marriage ſolemnity of the elector's half brother, duke John Erneſt, the invitation was accompanied with a memorandum, that what dreſſes of ceremony they might be deſirous of taking with them they ſhould tranſport in a ſmall waggon *. Had they been expected in coaches, ſuch a memorandum would have been ſuperfluous. The uſe of covered carriages was, for a long time, forbidden even to women. In the year 1545, the wife of a certain duke obtained from him, with great difficulty, permiſſion to uſe a covered carriage in a journey to the baths, in which, however, much pomp was diſplayed; but with this expreſs ſtipulation, that her attendants ſhould not have the ſame indulgence †. It is nevertheleſs certain, that the emperor, kings, and princes, about the end of the fifteenth century, began to employ covered carriages on journeys, and afterwards on public ſolemnities.

In the year 1474, the emperor Frederic III came to Francfort in a cloſe carriage; and as he remained in it on account of the wetneſs of the weather, the inhabitants had no occaſion to ſupport the canopy which was held over him, but while he went to the council-houſe, and again returned. In the

* Von Ludolf, Electa juris publici, ut ſupra.

† Sattler, in Hiſtoriſcher beſcreibung des herzogthums Würtemberg, im erſten theile, bey erläuterung einer urkunde vom jahr 1389.

year following, the emperor viſited the ſame city in a very magnificent covered carriage *. In the deſcription of the ſplendid tournament held by Joachim elector of Brandenburg, at Ruppin, in 1509, we read of a carriage all gilt over, which belonged to the electreſs; of twelve other coaches, ornamented with crimſon, and of another of the ducheſs of Mecklenburg, which was hung with red ſatin. At the coronation of the emperor Maximilian, in the year 1562, the elector of Cologne had twelve carriages. In 1594, when the margrave John Sigiſmund did homage at Warſaw on account of Pruſſia, he had in his train thirty-ſix coaches with ſix horſes each †. Count Kevenhiller, ſpeaking of the marriage of the emperor Ferdinand II with a princeſs of Bavaria, ſays, "The bride rode with her ſiſters in a ſplendid car-" riage ſtudded with gold; her maids of honour " in carriages hung with black ſatin, and the reſt " of the ladies in neat leather carriages." The ſame author mentions the entrance of cardinal Dietrichſtein into Vienna, in 1611, and tells us that forty carriages went to meet him ‡. At the election of the emperor Matthias, the ambaſſador of

* Lerſner, i. p. 106 and 108.

† Suite des Mémoires pour ſervir à l'Hiſt. de Brandenburg. p. 63. where the royal author adds, "The common uſe of carriages is not " older than the time of John Sigiſmund."

‡ Annal. Ferdin. V. p. 2199; and vii. p. 375. Von Moſers Teutſches hofrecht. Franc. and Leipſic 1755. 4to ii. p. 338.

Bran-

Brandenburg had three coaches *. When the conſort of that emperor made her public entrance, on her marriage, in 1611, ſhe rode in a carriage covered with perfumed leather †. Mary, infanta of Spain, ſpouſe of the ſucceeding emperor Ferdinand III, rode, in Carinthia, in 1631, in a glaſs carriage in which no more than two perſons could ſit ‡. The wedding carriage of the firſt wife of the emperor Leopold, who was alſo a Spaniſh princeſs, coſt together with the harneſs 38,000 florins §. The coaches uſed by that emperor are thus deſcribed by Kink: "In the imperial coaches no great magnificence was to be ſeen: they were covered over with red cloth and black nails. The harneſs was black, and in the whole work there was no gold. The pannels were of glaſs, and on this account they were called the imperial glaſs coaches. On feſtivals the harneſs was ornamented with red ſilk fringes. The imperial coaches were diſtinguiſhed only by their having leather traces; but the ladies in the imperial ſuite were obliged to be contented with carriages the traces of which were made of ropes." At the magnificent court of duke Erneſt Auguſtus, at Hanover, there were,

* In the laſt-quoted work but one, p. 63. it is remarked that they were coarſe coaches, compoſed of four boards put together in a clumſy manner.

† Kevenhiller, Annal. i. p. 34.

‡ Kevenhiller, xi. p. 1503.

§ Kink, Leben k. Leopold. p. 607.

in the year 1681, fifty gilt coaches with ſix horſes each *. So early did Hanover begin to ſurpaſs other cities in the number of its carriages. The firſt time that ambaſſadors appeared in coaches, on a public ſolemnity, was at the imperial commiſſion, held at Erfurth, in 1613, reſpecting the affair of Juliers †.

The great lords imagined at firſt that they could ſuppreſs the uſe of coaches by prohibitions. In the Churmark archives there is ſtill preſerved an edict, in which the feudal nobility and vaſſals are forbid the uſe of coaches, under pain of incurring the puniſhment of felony ‡. In the year 1588, duke Julius of Brunſwic publiſhed an order, couched in very expreſſive terms, by which his vaſſals were forbid to ride in carriages. This curious document is in ſubſtance as follows:—"As "we know from ancient hiſtorians, from the an- "nals of heroic, honourable, and glorious achieve- "ments, and even by our own experience, that the "reſpectable, ſteady, courageous, and ſpirited "Germans were, heretofore, ſo much celebrated "among all nations, on account of their manly "virtue, ſincerity, boldneſs, honeſty, and reſolu- "tion, that their aſſiſtance was courted in war, and "that, in particular, the people of this land, by

* Lunings Theatr. cer. i. p. 289.

† Ludolf, Electa juris publici, v. p. 416. Von Moſers Hofrecht, ii. p. 337.

‡ Ludewigs Gelehrte Anzeigen, i. p. 426.

"their

" their diſcipline and intrepidity, both within and
" without the kingdom, acquired ſo much celebri-
" ty, that foreign nations readily united with them:
" we have, for ſome time paſt, found, with great
" pain and uneaſineſs, that their uſeful diſcipline
" and ſkill in riding, in our electorate, county and
" lordſhip, have not only viſibly declined, but
" have been almoſt loſt (and, no doubt, other
" electors and princes have experienced the ſame
" among their nobility); and as the principal cauſe
" of this is that our vaſſals, ſervants and kinſmen,
" without diſtinction, young and old, have dared
" to give themſelves up to indolence and to riding
" in coaches, and that few of them provide them-
" ſelves with well-equipped riding horſes, and
" with ſkilful experienced ſervants, and boys ac-
" quainted with the roads: being not able to ſuffer,
" any longer, this neglect, and being deſirous to
" revive the ancient Brunſwic mode of riding,
" handed down and bequeathed to us by our fore-
" fathers, we hereby will and command, that all
" and each of our before-mentioned vaſſals, ſer-
" vants and kinſmen, of whatever rank or condition,
" always keep in readineſs as many riding horſes
" as they are obliged to ſerve us with by their fief,
" or alliance; and have in their ſervice able, expe-
" rienced ſervants, acquainted with the roads; and
" that they have as many horſes as poſſible, with
" poliſhed ſteel furniture, and with ſaddles proper
" for carrying the neceſſary arms and accoutre-

" ments, ſo that they may appear with them when " neceſſity requires. We alſo will and command " our before-mentioned vaſſals and ſervants to " take notice, that when we order them to aſſem- " ble, either all together, or in part, in times of tur- " bulence, or to receive their fiefs, or when on " other occaſions they viſit our court, they ſhall " not travel or appear in coaches, but on their " riding horſes, &c.*" Philip II, duke of Pomerania-Stetten, reminded his vaſſals alſo, in 1608, that they ought not to make ſo much uſe of carriages as of horſes †. All theſe orders and admonitions, however, were of no avail, and coaches became common all over Germany.

It would be difficult to give an exact deſcription of theſe carriages without a figure, and drawings or paintings of them do not ſeem to be common.

In the month of October 1785, when I viſited the ſenate houſe at Bremen, I ſaw in the tax-chamber a view of the city, painted on the wall in oil colours, by John Landwehr, in 1661. On the left ſide of the fore ground I obſerved a long quadrangular carriage, which did not appear to be ſuſpended by leather ſtraps. It was covered with a

* Lunig, Corp. jur. feud. Germ. ii. p. 1447.

† An attempt was made alſo to prevent the uſe of coaches by a law, in Hungary, in 1523. The words are: Et quod nobiles unius ſeſſionis per ſingula capita pariter inſurgere et advenire teneantur; et non in *Kotſi*, prout plerique ſolent, ſed exercitantium more, vel equites, vel pedites, ut pugnare poſſint, venire ſint obligati. *Schwarz, Pommerſchen leben-hiſtorie*, p. 497.

canopy

canopy ſupported by four pillars, but had no curtains, ſo that one could ſee all the perſons who were in it. In the ſide there was a ſmall door, and before there ſeemed to be a low ſeat, or perhaps a box. The coachman ſat upon the horſes. It was evident, from their dreſs, that the perſons in it were burgomaſters.

In the hiſtory of France we find many proofs that at Paris, in the fourteenth, fifteenth, and even ſixteenth centuries, the French monarchs rode commonly on horſes, the ſervants of the court on mules, and the princeſſes, together with the principal ladies, ſometimes on aſſes. Perſons of the firſt rank often ſat behind their equerry, and the horſe was often led by ſervants. When Charles VI wiſhed to ſee incognito the entrance of the queen, he placed himſelf on horſeback behind Savoiſy, who was his confidant, with whom, however, he was much incommoded in the crowd *. When Louis, duke of Orleans, that prince's brother, was aſſaſſinated in 1407, the two *ecuyers* who accompanied him rode both upon the ſame horſe †. In the year 1534, queen Eleonora and the princeſſes rode on white horſes *(des haquenées blanches)* during a ſacred feſtival. That private perſons alſo, ſuch as phyſicians for exam-

* Hiſtoire des antiquités de Paris, par Sauval, i. p. 187.

† Sauval; alſo Abregé chronologique de l'hiſtoire de France, par M. de Mezeray. Amſt. 1696. 3 vols. 12mo. iii. p. 167.

ple,

ple, uſed no carriages in the fifteenth century, is proved by the principal entrance to their public ſchool, which was built in 1472, being ſo narrow that a carriage could not paſs through it, though it was then one of the wideſt at that period *. In Paris alſo, at all the palaces and public buildings, there were ſteps for mounting on horſeback, ſuch as thoſe which the parliament cauſed to be erected in 1599; and Sauval ſays on this occaſion, that though many of theſe ſteps in latter periods had been taken away, there ſtill remained ſeveral of them in his time at old buildings.

Carriages, however, appear to have been uſed very early in France. An ordinance of Philip the fair, iſſued in 1294, for ſuppreſſing luxury, and in which the citizens' wives are forbid to uſe carriages (*cars*), is ſtill preſerved †. Under Francis I, or rather about 1550, ſomewhat later, there

* Variétés hiſtoriques, phyſiques et litteraires. Paris 1752. 3 vol. 12mo. ii. p. 87.

† The author of the laſt quoted work ſays, C'eſt une ordonnance de Philip le bel, de l'an 1292, qui eſt à la chambre des comptes au folio 44 d'un petit livre, lequel contient les ordonnances faites par Saint Louis pour la tranquillité du royaume; et qui ſe trouve auſſi dans le regiſtre noir du Chatelet de Paris; elle eſt même rapportée dans les notes et obſervations de la Thaumaſſiere ſur les coutumes de Beauvoiſois, page 371. Cette ordonnance eſt intitulée, *L'ordonnance que le roi Philippe le bel a fait faire des ſuperfluités oſter de toutes perſonnes, l'an* 1294. Le premier article eſt conçû en ces termes: *Premierement nulle bourgeoiſe n'aura char.* This ordonnance is to be found alſo in *Traité de la police, par De la Mare*, i. p. 418.

were

were at Paris, for the firſt time, only three coaches, one of which belonged to the queen, another to Diana de Poictiers, the miſtreſs of two kings, Francis I and Henry II, by the latter of whom ſhe was created ducheſs of Valentinois, and the third to René de Laval, lord of Bois-dauphin. The laſt was a corpulent unwieldy nobleman, who was not able to ride on horſeback *. Others ſay, that the three firſt coaches belonged to Catherine de Medicis; Diana ducheſs of Angoulême, the natural daughter of Henry II, who died in 1619 in the eightieth year of her age; and Chriſtopher de Thou, firſt preſident of the parliament. The laſt was excuſed by the gout; but the reſt of the miniſters of ſtate ſoon followed his example †. Henry IV was aſſaſſinated in a coach; but he uſually rode through the ſtreets of Paris on horſeback, and, to provide againſt rain, carried a large cloak behind him. For himſelf and his queen he had only one coach; as appears by a letter ſtill preſerved, in which he writes to a friend, "I cannot "wait upon you to-day, becauſe my wife is uſing "my coach ‡." We, however, find two coaches at the public ſolemnity on the arrival of the Spaniſh ambaſſador, don Peter de Toledo, under

* Variétés hiſtor. p. 92.

† Valeſiana. Paris 1695. 12mo. p. 35.

‡ Variétés hiſtoriques, p. 96.

Henry

Henry IV *. This contradiction is a circumſtance which is not worth farther reſearch; but it ſhews that all writers do not ſpeak of the ſame kind of carriages or coaches, and that every improvement has formed as it were an epoch in the hiſtory of them, which perhaps would be beſt elucidated by figures or engravings.

Roubo, in his coſtly treatiſe on joiners' work †, has given three figures of ſuch *(chars)* carriages as were uſed under Henry IV, from drawings preſerved in the king's library. By theſe one ſees that thoſe coaches were not ſuſpended by ſtraps, that they had a canopy ſupported by ornamented pillars, and that the whole body was ſurrounded by curtains of ſtuff or leather, which could be drawn up. The coach in which Louis XIV made his public entrance, about the middle of the laſt century, appears, from a drawing in the king's library, to have been a ſuſpended carriage.

The oldeſt carriages uſed by the ladies in England were known under the now forgotten name of *whirlicotes*. When Richard II, towards the end of the fourteenth century, was obliged to fly before his rebellious ſubjects, he and all his follow-

* Sauval ſays, I ſhall here remark, that this was the firſt time coaches were uſed for that ceremony (the entrance of ambaſſadors), and that it was only at that period they were invented, and began to be uſed.

† L'art du menuiſier-caroſſier, premier ſection de la troiſieme partie de l'art du menuſier. Par M. Roubo le fils, maitre-menuſier, 1771. fol. p. 457. planche 171. fig. 1, 2, 3 et 4.

ers

ers were on horſeback; his mother only, who was indiſpoſed, rode in a carriage. This, however, became afterwards ſomewhat unfaſhionable, when that monarch's queen, Ann, the daughter of the emperor Charles IV, ſhewed the Engliſh ladies how graceſully and conveniently ſhe could ride on a ſide-ſaddle. Whirlicotes were laid aſide, therefore, except at coronations and other public ſolemnities *. Coaches were firſt known in England about the year 1580, and, as Stow ſays, were introduced from Germany, by Fitz-allen, earl of Arundel †. In the year 1598, when the Engliſh ambaſſador came to Scotland, he had a coach with him ‡. Anderſon places the period, when coaches began to be in common uſe, about the year 1605: The celebrated duke of Buckingham, the unworthy favourite of two kings, was the firſt perſon who rode with a coach and ſix horſes, in 1619. To ridicule this new pomp, the earl of Northumberland put eight horſes to his carriage.

Towards the end of the thirteenth century, when Charles of Anjou made his entrance into Naples, the queen rode in a carriage, called by hiſtorians *caretta*, the outſide and inſide of which were co-

* The Survey of London, by John Stow. London 1633. fol. p. 70.

† Anderſon's Hiſt. of commerce, iv. p. 180.

‡ The Hiſt. of Edinburgh, by Hugh Arnot. Edin. 1779. 4to. p. 596.

vered

vered with ſky-blue velvet, interſperſed with golden lilies, a magnificence never before ſeen by the Neapolitans. At the entrance of Frederic II into Padua, in the year 1239, it appears there were no carriages, for the moſt elegantly dreſſed ladies that came to meet him were on palfreys ornamented with trappings (*ſedentes in phaleratis et ambulantibus palefredis*). It is well known that the luxury of carriages ſpread from Naples all over Italy *.

Coaches were ſeen for the firſt time in Spain in the year 1546. Such, at leaſt, is the account of Twiſs, who, according to his uſual cuſtom, ſays ſo without giving his authority †.

Towards the end of the ſixteenth century, John of Finland, on his return from England, among other articles of luxury, brought with him to Sweden the firſt coach ‡. Before that period, the greateſt lords in Sweden, when they travelled by land, carried their wives with them on horſeback. The princeſſes even travelled in that manner, and, when it rained, took with them a mantle of wax-cloth.

* This account is taken from *Obſervations ſur l'Italie et ſur les Italiens*, par M. Groſley. London 1774. 4 vol. 12mo. i. p. 326. The author quotes, as his authority, *Scriptores rerum Italicarum*, and *Rollandino Chron.* lib. iv. c. 9.

† Twiſs's Travels through Spain and Portugal.

‡ Dalin, Geſchichte des reichs Schweden, uberſetzt von Dahnert, iii. 1. p. 390 and 402.

It

It appears that there were elegant coaches in the capital of Ruſſia ſo early as the beginning of the laſt century *.

But to what nation ought we to aſcribe the invention of coaches? If under this name we comprehend covered carriages, theſe are ſo old as not to admit of any diſpute reſpecting the queſtion. To the following, however, one might expect an anſwer: Who firſt fell on the idea of ſuſpending the body of the carriage from elaſtic ſprings, by which the whole machine has undoubtedly been much improved? To this queſtion, however, I can find no anſwer, except the information before mentioned, that ſuſpended carriages were known in the time of Louis XIV.

As the name coach is now adopted, with a little variation, in all the European languages, ſome have thought to determine the country of this invention from the etymology of the word †. But even

* Eſſai ſur la bibliotheque de l'Academie des ſciences de St. Peterſburg, par J. Bacmeiſter, 1776. 8vo. p. 38.

† Joh. Ihre, Gloſſarium Sueogothic. i. col. 1178. *Kuſk* a coachman. It ſeems properly to denote the carriage itſelf. Gall. *cocher*. Hiſp. id. Ital. *cocchio*. Ang. *coach*. Hung. *coteczy*. Belg. *goetſe*. Germ. *kutſche*. The perſon who drives ſuch carriages is by the Engliſh called *coachman*, which in other languages is made ſhorter, as the French ſay *cocher*, and we *kuſk*. It is difficult, however, to determine whence it is derived, as we do not know by whom theſe cloſe carriages were invented. Menage makes it Latin, and by a far-fetched derivation from *vehiculum*; Junius derives it ſomewhat ſhorter from ὀχέω to carry. Wachter thinks it comes from the German word *kutten*, to cover;

even allowing that one could fix the origin of the word, it would by no means be aſcertained what kind of a carriage we ought properly to underſtand by it. Mr. Cornides * has lately endeavoured to prove, that the word *coach* is of Hungarian extraction, and that it had its riſe from a village in the province of Wieſelburg, which at preſent is called *Kitſee*, but was known formerly by the name of *Kotſee*, and that this travelling machine was even there firſt invented. However this may be, the grounds on which he ſupports his aſſertion deſerve to be here quoted, as they ſeem at leaſt to prove that in the ſixteenth century, or even earlier, a kind of covered carriages were known, under the name of Hungarian carriages †. As the word *gutſchi*,

cover; and Lye, from the Belgic *koetſen*, to lie along, as it properly ſignifies a couch or chair.

* Ungriſches Magaz. erſten bandes erſtes ſtuck. Preſsburg 1781, 8vo. p. 15.

† Stephanus Broderithus ſays, ſpeaking of the year 1526, "When "the archbiſhop received certain intelligence that the Turks had en- "tered Hungary, not contented with informing the king by letter of "this event, he ſpeedily got into one of thoſe light carriages, which, "from the name of the place, we call *kotczc*, and haſtened to his ma- "jeſty." Siegmund baron de Herberſtein, ambaſſador from Louis II to the king of Hungary, ſays, in *Commentario de rebus Moſcoviticis*, Baſil 1571, fol. p. 145, where he occaſionally mentions ſome ſtages in Hungary: "The fourth ſtage for ſtopping to give the horſes breath is "ſix miles below Taurinum, in the village of *Cotzi*, from which both "drivers and carriages take their name, and are ſtill generally called "*cotzi*." That the word *coach* is of Hungarian extraction is confirmed

gutſchi, and not *gutſche*, was uſed at firſt in Germany, the laſt ſyllable gives us reaſon to conjecture, that it is rather of Hungarian than German extraction. As Hortleder * tells us that Charles V, becauſe he had the gout, laid himſelf to ſleep in an Hungarian *gutſche*, one might almoſt conclude, that the peculiarity of theſe carriages conſiſted in their being ſo conſtructed as to admit people to ſleep in them. This conjecture is ſupported by the meaning of the word *gutſche*, which formerly ſignified a couch or ſopha †. As the writers quoted by Mr. Cornides call the Hungarian coaches ſometimes *(leves)* light, ſometimes *(veloces)* ſwift, one ought rather to conſider them as a particular kind of carriages for travelling with expedition. It is, however, ſtill more worthy of

ed alſo by John Cuſpinianus (Spieſshammer) phyſician to the emperor Maximilian I, in Bell's *Appar. ad hiſtor. Hungariæ*, dec. 1. monum. 6. p. 292. "Many of the Hungarians rode in thoſe light carriages "called in their native tongue *kottſchi*." In Dav. Czvittinger's *Specimen Hungariæ litteratæ*, Franc. et Lipſ. 1711, 4to. we find an account of the ſervice rendered to the arts and ſciences by the Hungarians; but the author no where makes mention of coaches.

* In his Account of the German war, p. 612.

† Examples may be ſeen in Friſch's Dictionary. From this meaning, thoſe beds, it appears, which are uſed for raiſing tobacco plants are at preſent called *tobacks kutſchen*, tobacco beds. This expreſſion is old; for I find in *Pet. Laurembergii Horticultura*, Franc. 1631, 4to. p. 43, the following paſſage: Solet a φιλοκηπωροις in paratu haberi peculiare terræ genus, quod ipſi prægnans ſtratum, *ein ſchwanger bett oder gutſche*, vocant.

remark, that, ſo early as the year 1457, the ambaſſador of Ladiſlaus V, king of Hungary and Bohemia, brought with him to the queen of France, beſides other preſents, a carriage which excited great wonder at Paris, and which, as an old hiſtorian ſays, was *branlant et moult riche* *. Does not the firſt word of this expreſſion ſeem to indicate that the carriage was ſuſpended?

A peculiar kind of coach has been introduced in latter times under the name of berlin. The name indicates the place which gave birth to the invention, as the French themſelves acknowledge; though ſome, with very little probability, wiſh to derive it from the Italian †. Philip de Chieſe, a native of Piedmont, and deſcended from the Italian family of Chieſa, was a colonel and quarter-maſter-general in the ſervice of Frederic William, elector of Brandenburg, by whom he was much eſteemed on account of his knowledge in architecture. Being once ſent to France on his maſter's buſineſs, he cauſed to be built, on purpoſe for this journey, a carriage capable of containing two perſons; which in France, and every where elſe, was

* Roubo, p. 457. The hiſtorian, however, gives it no name.

† *Berlin.* A kind of carriage which takes its name from the city of Berlin in Germany; though ſome perſons aſcribe the invention of it to the Italians, and pretend to find the etymology of it in *berlina*, a name which the latter give to a kind of ſtage on which criminals are expoſed to public ignominy. *Encyclopédie*, ii. p. 209.

much

much approved, and called a berline. This Philip de Chieſe died at Berlin in 1673 *.

Coaches have given riſe to a profeſſion which in large cities affords maintenance to a great number of people, and which is attended with much convenience; I mean that of letting out coaches for hire, known under the name of *fiacres*, hackney-coaches †. This originated in France; for about the year 1650 one Nicholas Sauvage firſt thought of keeping horſes and carriages ready to be let out to thoſe who might have occaſion for them. The Pariſians approved of and patroniſed this plan; and as Sauvage lived in the ſtreet St. Martin, in a houſe called the *hôtel S. Fiacre*, the coaches, coachmen and proprietor were called *fiacres*. In a little time this undertaking was improved by others, who obtained a licenſe for their new inſtitutions on paying a certain ſum of money ‡. Some kept coaches ready in certain places of the ſtreets, and let them out as long as was required, to go from one part of the city to another. Theſe alone, at length, retained the name of fiacre, which at firſt was common to every kind of hired car-

* Nicolai Beſchreibung von Berlin, anhang, p. 67.

† At Rome, however, there were carriages to be let out for hire: Suetonius calls them, i. chap. 57. *rhedameritoria*, and, iv. c. 39. *meritoria vehicula*.

‡ Charles Villerme paid in 1650, into the king's treaſury, for the excluſive privilege of keeping coaches for hire within the city of Paris, 15,000 livres.

riage without diſtinction. Others kept carriages at their houſes, which they let out for a half or whole day, a week, or a month: theſe coaches were known by the name of *caroſſes de remiſe*. Others kept carriages which at a certain ſtated time went from one quarter of the city to another, like a kind of ſtages, and took up ſuch paſſengers as preſented themſelves; and in the year 1662 ſome perſons ſet up carriages with four horſes, for the purpoſe of carrying people to the different palaces, at which the court might be: theſe were called *voitures pour la ſuite de la cour*. The proprietors often quarrelled reſpecting the boundaries preſcribed to them by their licenſes; and on this account they were ſometimes united into one company, and ſometimes ſeparated. The police eſtabliſhed uſeful regulations, by which the ſafety and cleanlineſs of theſe carriages were promoted; marks were affixed to them, by which they might be known; and young perſons and women of the town were forbidden to uſe them, &c.*

A particular kind of hackney carriage, peculiar to the Pariſians, in the opinion of ſome does no great honour to their urbanity. I mean the *brouettes*, called ſometimes *roulettes*, and by way of deriſion *vinaigrettes*. The body of theſe is almoſt like that

* A full hiſtory of the Pariſian *fiacres*, and the orders iſſued reſpecting them, may be ſeen in *Continuation du traité de la police*. Paris, 1738. fol. p. 435. See alſo *Hiſtoire de la Ville de Paris, par Sauval*, 1. p. 192.

of

of our ſedans, but rolls upon two low wheels, and is dragged forwards by men. An attempt was made to introduce ſuch machines under Louis XIII; but the proprietors of the ſedans prevented it, as they apprehended the ruin of their buſineſs. In the year 1669 they were however permitted, and came into common uſe in 1671, but were employed only by the common people *. Dupin, the inventor of theſe *brouettes*, found means to contrive them ſo that they did not jolt ſo much as might have been expected; and he was able to conceal this art ſo well, that for a long time he was the only perſon who could make them †. The number of all the coaches at Paris is by ſome ſaid to be fifteen thouſand; the author of *Tableau de Paris* reckons the number of the hackney coaches to amount to eighteen hundred, and aſſerts that more than a hundred foot paſſengers loſe their lives by them every year.

Coaches to be let for hire were firſt eſtabliſhed at London in 1625. At that time there were only twenty, which did not ſtand in the ſtreets, but at the principal inns. Ten years after, however, they were become ſo numerous, that king Charles I found it neceſſary to iſſue an order for limiting

* Continuation du traité de la police, p. 451.

† An account of the manner in which theſe *brouettes* were ſuſpended, may be ſeen in Roubo, p. 588.

their number. In the year 1637, there were in London and Weſtminſter fifty hackney coaches, for each of which no more than twelve horſes were to be kept. In the year 1652, their number had increaſed to two hundred; in 1654, there were three hundred, for which ſix hundred horſes were employed; in 1694, they were limited to ſeven hundred, and in 1715 to eight hundred *.

Hackney coaches were firſt eſtabliſhed at Edinburgh in 1673. Their number was twenty; but as the ſituation of the city was unfavourable for carriages, it fell in 1752 to fourteen, and in 1778 to nine, and the number of ſedans increaſed †.

Fiacres were introduced at Warſaw, for the firſt time, in 1778. In Copenhagen there are an hundred hackney coaches ‡.

In Madrid there are from four to five thouſand gentlemen's carriages ‖; in Vienna three thouſand, and two hundred hackney coaches.

At Amſterdam coaches with wheels were in the year 1663 forbidden, in order to ſave the expenſive pavement of the ſtreets §; for coaches there, even in ſummer, are placed upon ſledges, as thoſe at Peterſburgh are in winter. The tax upon car-

* Anderſon's Hiſtory of commerce, v. p. 6, 162, 187, 326, 347.

† Arnot's Hiſt. of Edinburgh, p. 598.

‡ Haubers Beſchreibung von Copenhagen, p. 173.

‖ Twiſs's Travels through Spain and Portugal.

§ Handveſten van Amſterdam, ii. p. 739.

riages

riages in Holland has from time to time been raiſed, yet the number has increaſed; and ſome years ago the coach horſes in the Seven United Provinces amounted to twenty-five thouſand *.

When prince Repnin made his entrance into Conſtantinople in 1775, he had with him eighty coaches, and two hundred livery ſervants.

WATER CLOCKS.

WE are well aſſured thatthe ancients had machines by which, through the help of water, they were able to meaſure time. The invention of them is by Vitruvius † aſcribed to Cteſibius of Alexandria, who lived under Ptolemy Euergetes, or about the year 245 before the Chriſtian æra. They were introduced at Rome by P. Cornelius Scipio Naſica, in the year 595 after the building of the city, or about 157 years before the birth of Chriſt ‡. How theſe water clocks were conſtructed, or whether they were different from the clepſydræ, I ſhall not enquire. If under the latter

* Des abbé Coyers Reiſe nach Italien und Holland. Nürnberg 1776. 8vo.

† Les dix livres d'architecture de Vitruve, par Perrault. Paris 1684. fol. p. 286. See alſo the original, lib. ix. c. 9.

‡ Scipio Naſica collega Lænatis primus aqua diviſit horas æque noctium ac dierum. Id horologium ſub tecto dicavit, anno DXCV. Tamdiu populo Romano indiſcreta lux fuit.

name we underſtand thoſe meaſurers of time which were uſed in courts of juſtice, the clepſydra is a Grecian invention, firſt adopted at Rome under the third conſulſhip of Pompey *. The moſt common kinds of theſe water clocks all, however, correſponded in this, that the water iſſued drop by drop through a hole of the veſſel, and fell into another, in which a light body that floated marked the height of the water as it roſe, and by theſe means the time that had elapſed. They all had this failing in common, that the water at firſt flowed out rapidly, and afterwards more ſlowly, ſo that they required much care and regulation †.

That ingenious machine, which we have at preſent under the name of a water clock, was invented in the laſt century. The preciſe time ſeems to be uncertain; but had it been before the year 1643 ‡, Kircher, who mentions all the then

* Eloquentiam illud forum magis exercebat, in quo nemo intra pauciſſimas horas perorare cogebatur, et liberæ comperendinationes erant, et modum dicendi ſibi quiſque ſumebat, et numerus neque dierum neque patronorum finiebatur. Primus tertio conſulatu Cn. Pompeius adſtrinxit impoſuitque velut frænos eloquentiæ. *Auctor dialog. de cauſ. cor. eloq.* 38.—The orators were confined to a certain time; and hence Cicero ſays, *latrare ad clepſydram*. TRANS.

† Some account of the writers who have ſpoken of the water clocks of the ancients may be found in *Fabricii Bibliograph. antiquaria*. p. 1011. They were formerly uſed for aſtronomical obſervations. The authors who treat of them in this reſpect are mentioned in *Riccioli Almageſt. novo*, i. p. 117.

‡ In that year Kircher's *Ars umbræ et lucis* was publiſhed for the firſt time. In the edition of 1671, ſeveral kinds of water clocks are deſcribed p. 698.

known

known machines of this kind, would in all probability have taken notice of it. It conſiſts of a cylinder divided into ſeveral ſmall cells, and ſuſpended by a thread fixed to its axis, in a frame on which the hour diſtances, found by trial, are marked out. As the water flows from the one cell into the other, it changes very ſlowly the centre of gravity of the cylinder, and puts it in motion *; much like the quickſilver puppets invented by the Chineſe †.

Theſe machines muſt have been very ſcarce in France in 1691; for Graverol at that time gave a figure and deſcription of the external parts of one, but promiſed to give the internal conſtruction as ſoon as he ſhould become acquainted with it ‡. This was the only one then in Niſmes. He ſays, alſo, that they were invented a little before by an Italian Jeſuit, who reſided at Bologna, but were brought to perfection by Taliaiſſon, profeſſor of law at Thouloufe, and a young clergyman named De l'iſle.

Alexander ſays more than once that this machine was invented at Sens in Burgundy, in 1690, by Dom Charles Vailly, a benedictine of the bro-

* A particular account of theſe water clocks is to be found in *Recréations mathematiques et phyſiques par M. Ozanam.* Paris 1696. 2 vol. 8vo. ii. p. 311, 473. Bion on Mathematical inſtruments. *Dom Jacob Alexanders Abhandlung von den uhren*, Lemgo 1738. 8vo. p. 82. and *Abhandlung von Waſſerubren, von M. G. H. B.* Halle 1752. 8vo.

† Muſchenbroek, Introductio in philoſ. natur. i. p. 143.

‡ Journal des Sçavans pour l'année 1691, quarto edition.

therhood

therhood of St. Maur, and that he brought it to perfection by the aſſiſtance of a pewterer there, named Regnard. This account is in ſome meaſure confirmed by Ozanam; for he ſays expreſſly, that the firſt water clocks were brought from Burgundy to Paris in 1693, and he deſcribes one which was made of tin at Sens *. Dom Charles Vailly was born at Paris in 1646, and died in 1726; he was celebrated on account of his mathematical knowledge, though he is known by no works, as he burned all his manuſcripts †.

Alexander, however, who was of the ſame order, ſeems to have aſcribed to his brother benedictine an honour to which he was not entitled; for Dominic Martinelli, an Italian of Spoletto,

* Did I know the inventor of a clock ſo ſimple and ſo extraordinary, I ſhould here do him juſtice. I know only that the firſt ſeen at Paris, this year, 1693, was brought from Burgundy. I have ſeen one of tin, made at Sens, the meaſure of which I ſhall here give. *Ozanam, Recréations*, ii. p. 311.

† This monk may be conſidered as the reſtorer of the clepſydra, or clock which meaſures time by the fall of a certain quantity of water confined in a cylindric veſſel. Theſe clocks were in uſe among ancient nations. They are ſaid to have been invented at the time when the Ptolemies reigned in Egypt. Dom Vailly, who applied particularly to practical mathematics, having remarked the faults of theſe clocks, beſtowed much labour in order to bring them to perfection; and by a number of experiments, combinations and calculations, he was at length able to carry them to that which they have attained at preſent. At the time of their revival they were very much in vogue in France. *Hiſtoire litteraire de la congregation de St. Maur, ordre de S. Benoit.* Bruxelles 1770, 4to. p. 478. The ſame article, without any variation, may be found in *Bibliotheque générale des écrivains de l'ordre de S. Benoit.* Bouillon 1778. 4 vol. 4to. iii. p. 171.

publiſhed

publiſhed at Venice, in 1663, a treatiſe written expreſſly on theſe water clocks, which Ozanam got tranſlated into French, by one of his friends, and cauſed to be printed with his additions*. This tranſlator ſays, that water clocks were known in France twenty years earlier than Ozanam had imagined. It appears, therefore, that they were invented in Italy about the middle of the laſt century, and that Vailly, perhaps, may have firſt made them known in France †.

It may, perhaps, afford ſome pleaſure to thoſe who are fond of the hiſtory of the arts, to know that Salmon, an ingenious pewterer at Chartres in France, has given very full and ample directions how to conſtruct and uſe this machine ‡. He is of opinion, that the invention is ſcarcely a century old; and that theſe water clocks, which are now common, were firſt made for ſale, and brought into uſe among the people in the country, by a pewterer at Sens in Burgundy. What this artiſt affirms, that they can be conſtructed of no metal ſo eaſily, ſo accurately, and to laſt ſo long as of tin, is perfectly true. I have, however, in my poſſeſſion one of braſs, which is well conſtructed; but it ſuffers a little from acids. Among

* Ozanam, Recréations, ii. p. 475.

† Alexander, who mentions Martinelli only in a curſory manner, will not admit this to be the caſe. "It is poſſible," ſays he, "that two perſons of penetrating genius may have diſcovered the ſame thing."

‡ Art du potier d'étain, par Salmon. Paris 1788. fol. p. 131.

the

the neweſt improvements to this machine may be reckoned an alarum, which conſiſts of a bell and ſmall wheels, like thoſe of a clock that ſtrikes the hours, ſcrewed to the top of the frame in which the cylinder is ſuſpended. The axis of the cylinder, at the hour when one is deſirous of being wakened, puſhes down a ſmall crank, which, by letting fall a weight, puts the alarum in motion. A dial-plate with a handle is alſo placed, ſometimes, over the frame.

TURMALIN.

THE ancients, though ignorant of electricity, were acquainted with the nature of amber, and knew that, when rubbed, it had the power of attracting light bodies. In like manner, they might have been acquainted with the turmalin, and might have known that it alſo, when heated, attracted light bodies, and again repelled them; for had they only bethought themſelves, in order to ſearch out the hidden properties of this ſtone (which on account of its colour and hardneſs is very remarkable), to put it into the fire, they would have then ſeen it ſport with the aſhes. Some learned men have thought they found traces of the properties of this ſtone, in what the ancients tell us reſpecting the *lyncurium*, *theamedes*, and *carbunculus*.

culus. The fruit of my reſearches reſpecting this ſubject I ſhall here lay before the reader. All that we find in the ancients to enable us to characteriſe the lyncurium is, that it was a very hard ſtone, which could with difficulty be cut; that ſeals were formed of it; that it was tranſparent, and of a fiery colour, almoſt like that of yellow amber; that it attracted light bodies, ſuch as chaff, ſhavings of wood, leaves, feathers, and bits of thin iron and copper leaf, in the ſame manner as amber; that the ancients procured it from Æthiopia, but that in the time of Pliny no ſtone was known under that name *.

This information proves, in my opinion, that the lyncurium cannot be the belemnites, as ſome old commentators and Woodward have affirmed; for the latter has not the celebrated hardneſs and tranſparency of the former, neither has it the property of attracting light bodies, nor is it fit for being cut into ſeals. That opinion probably has ariſen in the following manner: The ancients ſuppoſed that the lyncurium was the cryſtallized urine of the animal which we call the lynx. As ſome belemnites contain bituminous particles which give them an affinity to the ſwine-ſtone; naturaliſts, when they have rubbed or heated yellow and ſomewhat tranſparent pieces of this foſſil, have

* See Theophraſt. de lapidibus, edit. Heinſii. Lugd. Bat. 1613. fol. p. 395. and Plin. lib. xxxvii. c. 3. and lib. viii. c. 38.

imagined

imagined that they ſmelt the fabulous origin of the lyncurium.

Leſs ridiculous is the opinion of ſome old and modern writers, that the lyncurium was a ſpecies of amber. Theophraſtus, however, the ableſt and moſt accurate mineralogiſt of the ancients, would certainly have remarked this, and not have ſeparated the lyncurium from amber. Beſides, the latter has not the hardneſs of the former, nor can it be ſaid that it is difficult to be cut; for, at preſent, it is often made into various toys with much ingenuity. The opinion of Pliny is here of little weight; for it is formed, as ours muſt be, from the information of Theophraſtus.

Epiphanius, who conſidered the Bible as a ſyſtem of mineralogy, but could not find the lyncurium in it, ſuppoſes that it may have been the hyacinth *. However ridiculous the cauſe of this conjecture may be, it muſt be allowed that it is not entirely deſtitute of probability; and I ſay with John de Laet, "The deſcription of the lyncurium does not "ill agree with the hyacinth of the moderns †." If we conſider its attracting of ſmall bodies in the ſame light as that power which our hyacinth has in common with all ſtones of the glaſſy ſpecies, I cannot ſee any thing to controvert this opinion,

* Epiphanius de xii gemmis.

† J. de Laet de gemmis. Lugduni Bat. 1647. 8vo. p. 155. Sane deſcriptio lyncurii non male convenit cum hyacintho neotericorum.

and

and to induce us to believe the lyncurium and the turmalin to be the ſame. The grounds which Watſon produces for this ſuppoſition, are more in favour of the hyacinth than the turmalin *. Had Theophraſtus been acquainted with the latter, he would certainly have remarked that it did not acquire its attractive power till it was heated. At preſent at leaſt, no turmalin is known to attract until it is heated; though it would not appear very wonderful if a ſtone like the magnet ſhould retain its virtue for a long time.

The duke of Noya Caraffa believes the theamedes of the ancients to have been the turmalin †. Of that ſtone we are told, by Pliny, only that it poſſeſſed a power contrary to the power of the magnet; that is, that it did not attract but repel iron ‡. But this only proves, that it had then been remarked that the magnet repelled the negative pole of a piece of magnetic iron. This account has been thus explained by Boot ||. To induce us to conſider the theamedes as the turmalin, Pliny ought to have ſaid that it attracted iron and then repelled it.

* Philoſophical Tranſact. v. li. 1. p. 394.

† Recueil de memoires ſur la tourmaline, par Aepinus. St. Peterſburg 1762. 8vo. p. 122.

‡ Alius rurſus in eadem Aethiopia non procul mons gignit lapidem theamedem, qui ferrum omne abigit reſpuitque. Compare with this paſſage lib. xx. c. 1.

|| Gemmarum et lapidum hiſtoria. Lugduni Bat. 1647. 8vo. p. 441, 450.

With

With much greater probability may we conſider as the turmalin a precious ſtone, claſſed by Pliny among the numerous varieties of the carbuncle *; for, however perplexed and unintelligible his account of the carbuncles may be, and however much the readings, in the different copies, may vary, we ſtill know that he deſcribes a ſtone which was very hard; which was of a purple, that is a dark violet colour, and uſed for ſeals, and which when heated by the beams of the ſun, or by friction, attracted chaff and other light bodies. Had Pliny told us that it firſt attracted and then repelled them, no doubt would remain; but he does not ſay ſo, nor do his tranſcribers Solinus and Iſiodorus †.

A much later account of a ſtone that, when rubbed, is, like the magnet, endued with an at-

* Et inter has invenio differentiam; unam quæ purpura radiat; alteram quæ cocco; a ſole excalfactas, aut digitorum attritu, paleas, et chartarum folia ad ſe rapere. Hoc idem et carchedonius facere dicitur, quamquam multo vilior prædictis. So reads Harduin; but Saumaiſe, from the authority of manuſcripts, ſays the paſſage ought to run thus: Et inter has invenio differentiam. Una purpura radiat, altera cocco. A ſole excalefacta, aut digitorum attritu, paleas et chartarum fila ad ſe rapit. *Plin.* lib. xxxvii. c. 7.

† India produces alſo the lychnites, the ſplendor of which is heightened when ſeen by the light of lamps; and on this account it has been ſo called by the Greeks. It is of two colours; either a bright purple, or a clear red, and if pure is thoroughly tranſparent. When heated by the rays of the ſun, or by friction, it attracts chaff and ſhavings of paper. It obſtinately reſiſts the art of the engraver. *Solinus*, c. lii. p. 59. ed. Salmaſii. Trajecti ad Rhenum 1689. fol.

tractive power is to be found in a paſſage of John Serapion, the Arabian, pointed out to me by profeſſor Butner *. This ſtone, indeed, cannot with much probability be taken for the turmalin, as all precious ſtones, when heated, have the ſame property; but it is worthy of remark, that, like the lyncurium of the ancients, it belongs to the hyacinths, the colour of which many of the real turmalins have; and among thoſe of the iſland of Ceylon there are, perhaps, ſome which ought to be claſſed among the hyacinths, rather than among the ſhirls.

The real turmalin was firſt brought from Ceylon, and made known by the Dutch, about the end of the laſt or the beginning of the preſent century. It is commonly believed, that the firſt account of it ever publiſhed is that to be found in the Memoirs of the Academy of Sciences at Paris, for the year 1717; but it appears, that fuller and more accurate deſcriptions of the properties of that ſtone were given in German works ten years before. The earlieſt information that I

* Hager albuzedi is a red ſtone, but leſs ſo than the hyacinth, the redneſs of which is more agreeable to the eye, as there is no obſcurity in it. The mines where this ſtone is found are in the Eaſt. When taken from the mine it is opaque; but when diveſted of its outer coat by a lapidary, its goodneſs is diſcovered, and it becomes tranſparent. When this ſtone has been ſtrongly rubbed againſt the hair of the head it attracts chaff, as the magnet does iron. *Joan. Serapionis Lib. de ſimplicibus medicinis.* Edit. Othonis Brunfelſii. Argentorati 1531. fol. p. 263.

know reſpecting it is in a book, now almoſt and juſtly forgotten, entitled *Curious ſpeculations during ſleepleſs nights* *. In a paſſage, where the author, ſpeaking of hard and glaſſy bodies which attract light ſubſtances, affirms that this property is not magnetic, he ſays, "the ingenious Mr. Daumius, "chief phyſician to the Poliſh and Saxon troops "on the Rhine, told me, that in the year 1703 "the Dutch firſt brought from Ceylon in the "Eaſt Indies a precious ſtone called turmalin, or "turmal, and named alſo *trip*, which had the "property, that it not only attracted the aſhes "from the warm or burning coals, as the magnet "does iron, but alſo repelled them again, which "was very amuſing; for as ſoon as a ſmall quan-"tity of aſhes leaped upon it, and appeared as if "endeavouring to writhe themſelves by force into "the ſtone, they in a little ſprang from it again, "as if about to make a new attempt; and on this "account it was by the Dutch called the *aſhes-"drawer*. The colour of it was an orange red "heightened by a fire colour. When the turf "coals were cold, it did not produce theſe "effects, and it required no care like the magnet.

* Curioſe ſpeculationes bey ſchlaf-loſen nachten, von einem liebhaber der immer gern ſpeculirt. Chemnizs und Leipzig, bey Conr. Stoſſeln, 1707. 857 pages in octavo. The author's name, which I am not able to conjecture, appears to be expreſſed by the initials I. G. S. This work conſiſts of forty-eight dialogues, each twelve of which have a diſtinct title. Bruckman quotes it in *Magnalia Dei*, p. 302.

"I have

" I have conſidered whether it would not attract " and repel the aſhes of other burning coals as " well as thoſe of turf; and I have no doubt, that, " if heated, it would attract other things beſides " aſhes."

This whole paſſage has been inſerted word for word, without variation or addition, and without telling the ſource from which taken, in a book, perhaps equally forgotten, called *Obſervationes curioſo-phyſicæ, or Remarks and obſervations on the great wonders of the world*, by Felix Maurer, phyſician and philoſopher *. This thick volume is entirely compiled from a number of works, the names of which are not mentioned.

In the catalogue of the collection of natural curioſities belonging to Paul Hermann, which were ſold at Leyden in June 1711, I find, among the precious ſtones, *Chryſolithus Turmale Zeylon.* † Though no deſcription is added, it cannot be doubted that our turmalin is here meant. From this, however, we learn that the name together with the ſtone came to us from Ceylon, as Watſon has remarked, and that we ought not to write it *tourmaline*, after the French. We learn farther, that the ſtone was at firſt conſidered as a chryſolite, and perhaps it may be mentioned under this

* Frankf. und Leipzig bey Buggeln, in Nurnberg 1713. 8vo. 1039 pages.

† Catalogus muſei Indici collecti a P. Hermanno. Lugduni Bat. 8vo. 52 pages.

name in the old accounts of Ceylon. Hermann, whoſe ſervice to botany is well known, was in that iſland from 1670 to 1677; and it might be preſumed, from his ſpirit of enquiry, that, had he known this ſtone, he would ſomewhere or other in his works have taken notice of its properties: but I find no mention of it either in his *Cynoſura materiæ medicæ* *, or in *Muſæum Zeylonicum* †.

In the year 1719 the Academy of Sciences at Paris announced in their memoirs for 1717, that in the latter year Mr. Lemery had laid before them a ſtone found in a river in the iſland of Ceylon, which attracted and repelled light bodies ‡.

* Argentorati 1726. 4to.

† Edit. ſec. Lugduni Bat. 1726. 71 pages 8vo. This work is only a catalogue of the plants of Ceylon, with the Engliſh names, publiſhed by William Sherard, which Haller has not remarked in his Biblioth. Bot. ii. p. 16.

‡ I ſhall here lay before the reader the whole paſſage, taken from *Hiſtoire de l'Académie* for 1717, p. 7. Here we have a ſmall magnet. It is a ſtone found in a river of the iſland of Ceylon. It is of the ſize of a denier, flat, orbicular, about the tenth part of an inch in thickneſs, of a brown colour, ſmooth and ſhining, without ſmell, and without taſte, which attracts and afterwards repels ſmall light bodies, ſuch as aſhes, filings of iron, and bits of paper. It was ſhewn by Mr. Lemery. It is not common, and that which he had coſt twenty-five livres (about twenty ſhillings ſterling). When a needle has been touched with a loadſtone, the ſouth pole of the loadſtone attracts the north pole of the needle, and repels its ſouth pole: thus it attracts or repels different parts of the ſame body, according as they are preſented to it, and it always attracts or repels the ſame. But the ſtone of Ceylon attracts, and then repels in the like manner, the ſame ſmall body preſented to it: in this it is very different from the loadſtone. It would ſeem that it has a vortex. - - -

It

It is there called a ſmall magnet, though ſome difference between the two ſtones was admitted; but the German naturaliſt, before mentioned, denies that the turmalin is endowed with magnetic virtue. It is however very remarkable, that though it is ſaid, in the Memoirs of the Academy, that it has the power of attracting and repelling, no mention is made that it acquires that property, only after it has been heated, which is expreſſly remarked by the German. Thoſe, therefore, who wiſh to aſcribe to the ancients a knowledge of the turmalin may ſay, If the editor of the Memoirs of the French Academy could forget this circumſtance, may we not readily allow that Theophraſtus might have forgot it, in deſcribing the lyncurium; Pliny, in deſcribing the carbuncle; and Serapion, in deſcribing his hyacinth?

After this period the turmalin muſt have been very ſcarce in Europe; for when Muſchenbroek made his well-known experiments with the loadſtone, and ſpared no labour to carry them to the utmoſt extent, he was not acquainted with the turmalin, which, according to the account given of it by the Academy at Paris, he conſidered as a magnet, as he himſelf ſays in the preface to his firſt diſſertation, publiſhed in 1724 *.

About the year 1740, however, ſome German

* The magnet of the iſland of Ceylon, deſcribed by the learned academicians of Paris, I have not yet examined. *Diſſertationes phyſicæ experimentales.* Viennæ 1756. 4to. p. 10.

naturaliſts made experiments with this ſtone, in order to diſcover the real cauſe of its attractive property. Theſe may be ſeen, under the article *Trip*, in the well-known Dictionary of Natural Hiſtory which is often printed with Hubner's preface; but I do not know to whom the honour belongs of having firſt inveſtigated the nature of this ſtone. As the above dictionary is common, I ſhall give here only a very ſhort extract from it. "This ſtone was brought to Holland by ſome perſons who had travelled in India, from the iſland of Ceylon, where it is found, pretty frequently, among the fine ſand, near Columbo, and ſold to the German Jews. Theſe cauſed it to be cut thinner, and the price of it ſoon roſe to eight and ten Dutch florins. It has been ſince much dearer; but at preſent it is cheaper. It attracts not only aſhes, but alſo metallic calces: it however attracts more eaſily and with greater force thoſe which have been formed by means of ſal ammoniac, or the ſpirit of that ſalt. It acquires its attractive power only after it has been moderately heated; for when cold or heated to a greater degree it produces no effect, which the author aſcribes to its being united with martial ſulphur. The chryſolites and other precious ſtones of the iſland do not poſſeſs the ſame property." As the author quotes the *Laboratorium Zeylonicum* *, I conſulted

* Inſulæ Ceyloniæ thеſaurus medicus, vel Laboratorium Ceylonicum, a Pielat

consulted it, but found no information in it respecting the turmalin. The first person who thought of explaining the property of the turmalin by electricity was the great Linnæus, who, in the preface to his *Flora Zeylanica* *, where he enumerates the productions of the island, calls it the electrical stone; but at that time, as he himself afterwards told me, he had not seen it.

What Linnæus only conjectured, Mr. Æpinus proved at Berlin, in 1757, by accurate observation and experiments, when endeavouring with Mr. Wilke to investigate the secret of negative and positive electricity. The history of their discoveries I shall here omit, as a better account of them than I could give has been published in the Transactions of the Swedish Academy † by Mr. Wilke, to whom the public are indebted for, perhaps, the best elucidation of the laws of the electricity of turmalin.

a Pielat latinitate donatum. Amstelod. 1769. 12mo. The author, whose name is not mentioned by the illiberal translator, was H. N. Grimm, a Swede.

* I must not omit to mention that the rivers contain the electric stone, which is of the size of a halfpenny, flat, orbicular, shining, smooth, of a brown colour, one tenth of an inch in thickness, without smell and without taste, and which attracts light bodies, such as ashes, filings of iron, shavings of paper, &c. and afterwards repels them. A wonderful and singular property, discovered and observed in this stone alone, when neither heated by motion nor by friction. *Flora Zeylanica*. Holmiæ 1747. 8vo. p. 8.

† In the German translation, xxviii. p. 95. xxx. pp. 1 and 105.

SPEAKING-TRUMPET.

INSTRUMENTS by which the voice could be ſo ſtrengthened as to be heard at a much farther diſtance than would otherwiſe have been poſſible, were known in the earlieſt ages; for of all muſical inſtruments, wind inſtruments were firſt invented, and their uſe in war, to give the ſignal of battle, we find mentioned in Job *. It had been remarked, even in Pliny's time, that the leaſt touching of a beam of wood could be heard when one placed one's ear at the other end †. It was known, likewiſe, that the larger trumpets were, they emitted a louder and ſtronger ſound. The Grecians had a wind inſtrument with the bellowing noiſe of which the people who were placed to guard the vineyards frightened away the wild animals ‡. All theſe wind inſtruments, however, were

* Goguet, l'Origine des loix et des ſciences chez les anciens peuples.

† Ideo fit ut, aure ad caput trabis quamlibet prælongæ admota, ictus ab altero capite vel graphii ſentiatur, penetrante rectis meatibus ſono. *Plin.* lib. xvi. c. 38. ii. p. 32.

‡ Si quis in amphoræ urceolo, aut anguſta illa parte quam amphoræ collum dicimus, impellat vi et impetu aerem et expellat, ſonum producet horridum, ac timorem belluis incutientem: tali inſtrumento cuſtodes vinearum et fructuum ad avertendas belluas utuntur. *Septalii Commentaria in Ariſtotelis problemata.* Lugduni 1632. fol. p. 206. lib. xxv. prob. 2. To the ſame purpoſe is the following paſſage of Seneca,

were little in compariſon of the monſtrous trumpets of the ancient Chineſe, a kind of ſpeaking-trumpets, or inſtruments by which words could not only be heard at the greateſt diſtance poſſible, but could be alſo underſtood *. This invention belongs to the laſt century, though ſome think that traces of it are to be found among the ancient Grecians.

Kircher, as far as I have been able to learn, was the firſt perſon who made known, from a very ancient manuſcript of Ariſtotle, *De Secretis ad Alexandrum Magnum*, preſerved in the Vatican, that Alexander had a prodigious large horn with which he could aſſemble his army at the diſtance of an hundred ſtadia, or eight Italian miles. It was, according to the manuſcript, five cubits in diameter; and Kircher, who gives a figure of it, which he ſays he found in the manuſcript, thinks that, on account of its ſize, it muſt have been ſuſpended from a beam by a ring. This horn has by many been

Senecca, pointed out to me by profeſſor Hollmann, and which almoſt ſeems to allude to a ſpeaking trumpet: Nam quemadmodum ſpiritus noſter clariorem ſonum reddit, cum illum tuba, per longi canalis anguſtias tractum, patentiore noviſſime exitu effudit; ſic ſenſus noſtros clariores carminis arcta neceſſitas efficit. *Epiſt.* 108.

* See Anciennes relations des Indes et de la Chine, de deux voyageurs Mahometans, qui y allèrent dans le neuviémé ſiécle. Par Renaudot. Paris 1718. 8vo. p. 25. Theſe large trumpets are by Holler in his *Elementa phyſiologiæ*, vol. v. Lauſannæ 1763, 4to. p. 263, improperly called ſpeaking-trumpets.

conſidered

conſidered as the oldeſt ſpeaking-trumpet *; but, in my opinion, without reaſon. *Ariſtotelis Secretum Secretorum ad Alexandrum Magnum* I have never had an opportunity to ſee. It appears to have been printed only once, and is, like all the other works aſcribed to that philoſopher, extremely ſcarce; for they have all had the fate of being little regarded after it became the unanimous opinion of the learned that they were forged. Theſe works, however, are old; ſome of them indeed very old; and, if one ſhould take the trouble to fix their antiquity, they might be uſed with advantage on many occaſions. Morhof had in his poſſeſſion the edition of that book publiſhed by Alexander Achillinus, a phyſician at Bologna, in 1516, which is

* Ars magna lucis et umbræ. Amſtelodami 1671. fol. p. 102. Kircher repeats this account with ſome new circumſtances in his *Phonurgia*, p. 132. Aguntur jam cumpluria luſtra, quibus in bibliotheca Vaticana, hieroglyphicum agens Oedipum, caſu inciderem in librum cui titulus erat, Secreta Ariſtotelis ad Alexandrum Magnum; ubi inter cætera de cornu prodigioſo Alexandri M. hæc leguntur: Faciebat hoc cornu adeo vehementem ſonum, ut eo exercitum ſuum ad centum ſtadia (quorum octo unum milliare Italicum conficiunt) diſperſum convocaſſe perhibeatur; habebat autem, ut libellus monſtrat, quinque cubitos in diametro; et fulcri ſuſpendebatur annulo, uti ego reor, cujus tamen figuram non deſcribit. Figuram hic appono, prout in dicto libello impreſſam reperi, cum epigraphe: Cornu Alexandri Magni. It would appear from what Kircher here ſays, that he had ſeen the book printed: but in the firſt quoted work he ſays expreſsly, *Reperi in antiquiſſimo codice.*

a latin

a latin tranſlation from the Arabic *. If we compare what is ſaid there and by Kircher, we may make the following concluſion:

In the firſt place, it is certain that the book itſelf, as well as the whole account, is not the production of Ariſtotle; for in all the writers who relate the actions of Alexander we do not find the leaſt mention of ſuch a horn. Secondly, it is not expreſsly ſaid in that work, that Alexander ſpoke through this horn; but only that he aſſembled his ſoldiers by it, which in paſt times was done by the ſound of a trumpet, and at preſent is done both by trumpets and drums. It appears alſo that the author of the book, perhaps an Arabian, intended to give the reader an idea of a horn that had an uncommonly ſtrong and loud ſound. Thirdly, Kircher's account and figure of the horn do not agree with that which Morhof found in the edition of Achillinus †. Laſtly, none of theſe de-

* Morhofii Diſſ. de vitro per vocis ſonum rupto, in Diſſertationibus academicis. Hamburgi 1669. 4to. p. 381. See alſo Fabricii Biblioth. Græca, vol. ii. b. 3. p. 167.

† Morhof quotes from the book the following paſſage: Hoc æneo cornu mirabili artificio fabricato Alexander rex magnificus ex lx. milliaribus exercitum ſuum convocavit. Quod ob illius inæſtimable artificium et excedentem magnitudinem lx. viris regebatur. Verum multa reſonantium metallorum genera in ejus compoſitonem concurrebant. *With this brazen horn, conſtructed with wonderful art, Alexander the Great called together his army at the diſtance of ſixty miles. On account of its ineſtimable workmanſhip and monſtrous ſize, it was under the management of ſixty men. Many kinds of ſonorous metal were combined in the compoſition of it.*

ſcriptions are ſuch, that an inſtrument to ſerve as a ſpeaking-trumpet could be conſtructed from them.

Wolf and other mathematicians are of opinion that the moſt advantageous form of a ſpeaking-trumpet would be found with more certainty by experience than by theory. It may then be aſked, whether any one ever cauſed ſuch an inſtrument to be made from theſe deſcriptions. Kircher, who attempted things much more improbable, ſays he never tried it. Duhamel, however, relates that a Frenchman tried it, and diſcovered the real inſtrument *: but this information is of little weight, as it is much to be doubted that this Frenchman cauſed it to be made ſufficiently exact according to the ancient deſcription. I am as little acquainted with Bettini as Morhof; but I ſuſpect that Duhamel meant Mar. Bettini, who, without making the ſmalleſt mention of Alexander's horn, propoſes only a tube, the one end of which ſhould be applied to the mouth of a perſon who ſpeaks,

* Among many things which the celebrated D'Alance cauſed to be made for this purpoſe, that trumpet aſcribed to Alexander, and with which he called together his army, ought not to be omitted. As the figure of it was repreſented in an old manuſcript in the Vatican library, and had been deſcribed by Bettini, that learned man was deſirous of trying whether it could be proved by experience, and the attempt ſucceeded; for that kind of trumpet, if it does not excel, ſeems undoubtedly to equal the other inſtruments conſtructed for that end. *De corpore animato*, lib. ii. cap. 4. in *Joh. Bap. du Hamel, Opera philoſophica*, Norimbergiæ 1631. 2 vol. 4to. ii. p. 560.

and

and the other to the ear of one who is dull of hearing *. This was rather an ear-trumpet than a ſpeaking-trumpet, and it is certain that the former was invented before the latter.

What we read in Porta, and what many think alludes to a ſpeaking-trumpet, alludes evidently to an ear-trumpet only. That author infers, very juſtly, from the form of the ear, and particularly from that of the ears of thoſe animals which are quick of hearing, that to hear at a diſtance one muſt apply to the ear a kind of wide funnel, as people to ſtrengthen the ſight uſe ſpectacles †. He aſſerts alſo, with equal truth, that one, through a long tube, can convey a whiſper to the ear of another perſon at a very great diſtance ‡; an experiment which he himſelf made at the diſtance of two hundred paces. Schwenter, who wrote before the ſpeaking-trumpet was known, propoſes, from

* Apiaria univerſæ philoſophiæ mathematicæ, auctore Mario Bettino. Bononiæ 1642. fol. Apiarium decimum, pag. 38.

† Magia natural. lib. xx. c. 5. p. 653.

‡ To communicate any thing to one's friends by means of a tube. This can be done with a tube made of earthen ware, though one of lead is better, or of any other ſubſtance, but very cloſe, that the voice may not be weakened; for whatever you ſpeak at the one end, the words iſſue perfect and entire as from the mouth of the ſpeaker, and are conveyed to the ears of the other; which, in my opinion, may be done for ſome miles. The voice, neither broken nor diſperſed, is carried entire to the greateſt diſtance. We tried it at the diſtance of two hundred paces, not having convenience for a greater; and the words were heard as clearly and diſtinctly as they came from the mouth of the ſpeaker. Lib. xvi. c. 12. p. 568.

the hint of Porta, an ear trumpet one end of which ſhould be applied to the ear *.

Reſpecting the invention of the ſpeaking-trumpet, Sir Samuel Morland an Engliſhman, and the jeſuit Kircher, have, in latter times, contended. The former, in 1671, publiſhed a particular deſcription of one, after he had made many experiments upon it the year preceding. This inſtrument, ſhaped like a wide-mouthed trumpet, he cauſed firſt to be conſtructed of glaſs, and afterwards of copper, with various alterations, and performed ſeveral experiments with it in preſence of the king, prince Rupert, and other perſons, who were aſtoniſhed at its effects †.

As an account of this diſcovery was ſoon ſpread all over Europe, Kircher aſſerted, that he had conſtructed ſpeaking-trumpets before Sir Samuel Morland, and ſupported his aſſertion by referring to his former writings; and by the teſtimony of other authors. I ſhall firſt take notice of the former. His *Ars magna lucis et umbræ* was firſt printed in 1643. I at leaſt conclude ſo, becauſe, in the preface to his *Phonurgia*, printed in 1673, he ſays,

* Mathematiſche erquickſtunden, i. p. 243.

† An account of the ſpeaking trumpet, as it hath been contrived and publiſhed by Sir Samuel Morland, knight and baronet, together with its uſe both at ſea and land. London 1671. An extract from it may be ſeen in the Philoſophical Tranſactions, no. 78. page 3056. A complete tranſlation was printed in *Recueil des mémoires et conférences ſur les arts et les ſciences, pendant l'année* 1672, par J. B. Denis.

that

that work had been publiſhed thirty years before. The ſecond edition is of 1671, in which I find only the already quoted paſſage reſpecting Alexander's horn, and the figure of a tube which, like that propoſed by Bettinus, ſhould be applied to the ear of the perſon who hears, and to the mouth of the ſpeaker. The *Muſurgia*, printed in 1650, contains better grounds for ſupporting the aſſertion of Kircher *. In the ſecond part he deſcribes how a funnel can be placed in a building in ſuch a manner, that a perſon in an apartment where the narrow end is introduced can hear what is ſpoken without the building, or in another apartment, where the wide end may be. To this deſcription a figure is added, and the author acknowledges he was led to that idea by the conſtruction of a well-known building of Dionyſius †. He

* Muſurgia univerſalis, ſive Ars magna conſoni et diſſoni. Romæ 1650. fol. p. 303.

† Among the antiquities of Syracuſe, in Sicily, one beholds with wonder chambers and galleries which are hewn out in the ſolid rock, and particularly a grotto, from which ariſes a winding paſſage, that becomes upwards ſtill narrower. Ancient tradition ſays, that this was a priſon, which the celebrated tyrant Dionyſius cauſed to be built for ſtate priſoners, that in an apartment of his palace, which ſtood over the narrow end of the paſſage, he might hear every thing the priſoners ſaid, or what plots they formed againſt him. This grotto, therefore, is called *Orecbio di Dionyſio*, or *la grotta della favella*; *auris Dionyſii*, the ear of Dionyſius. Many travellers and others formerly imagined that this paſſage was an ingenious imitation of that part of the human ear called the helix; which was firſt remarked by Alcmaon the

He does not, however, ſay expreſsly that he had ever tried the experiment; but in the laſt page of the

the Pythagorean. This is the account given by Kircher, who was there in the year 1638. See his *Phonurgia*, page 82. where there is a figure of it. In later times, however, this grotto has been examined with more ſkill and acuteneſs by people leſs ſubject to prejudice, and ſince that period the ſuppoſed wonder has been leſſened. The rock conſiſts of lime ſtone, at leaſt I conclude ſo from what is ſaid by Brydone, who found it every where full of cracks and fiſſures. The ſtones of which Syracuſe was built were hewn from the rock; and hence have been formed theſe chambers or openings, like thoſe found in the neighbourhood of other ancient and modern cities, ſuch as Rome, Naples, and Maeſtricht. Many of theſe, in the courſe of time, have been employed as priſons, or uſed as burying-vaults. The above-mentioned paſſage, which has excited ſo much wonder, is not properly ſpiral, and is of ſuch a figure that it may have been produced either by accident, or through the whim of the workmen employed to hew out the ſtones. The double echo, which Kircher aſſures us he heard in the grotto, was not remarked by Schott, who was there in 1646, as he expreſsly ſays, in oppoſition to his brother jeſuit, in his *Magia naturalis*. In the accounts ſtill remaining of Dionyſius we find mention of an aſtoniſhing priſon, which is well deſcribed by Cicero, in his fifth oration againſt Verres: "You have all heard of," ſays he, "and moſt of you know, "the priſon (lautumias) of Syracuſe. It is an immenſe and magni- "ficent work, executed by kings and tyrants; the whole is ſunk to a "wonderful depth in the rock, and has been entirely cut out by the "labour of many hands. No place ſo ſecured againſt an eſcape; no "place ſo encloſed on all ſides; no place ſo ſafe for confining priſon- "ers can be either planned out or conſtructed." But it cannot be proved, and according to D'Orville's opinion it is improbable, that this grotto was the work of that tyrant, who, as Plutarch tells us in the Life of Dion, employed very different means to learn the intention of dangerous perſons. "The common people attacked the tyrant's "friends, and ſeized thoſe whom they called his emiſſaries (προσαγω- "γιδας), worthleſs men, deteſted by the gods. Theſe went about the "city, mixed with the citizens, and, prying into every thing, gave an

"account

the preface to the *Phonurgia*, he pretends that ſo early as the year 1649 he had cauſed ſuch a machine to be fixed up in the Jeſuits' college. But, ſuppoſing this to be true, it can only be ſaid that he then approached very near to the invention of the ſpeaking-trumpet, by an inſtrument, however, which, in reality, was calculated to ſtrengthen the hearing, and not the voice; and therefore only the half is true of what he advanced in his preface in 1673, that twenty years before he had deſcribed in his *Muſurgia* the trumpet invented in England.

In the *Phonurgia* *, however, written after Morland's publication was every where known, Kircher certainly treats of the ſpeaking-trumpet, and ſays that, from the ſimilarity of the progreſs of

" account to the tyrant of what they thought, and what expreſſions " they made uſe of." It was merely for its ſtrength, and the labour employed in building it, and not on account of its ingenious conſtruction, that the ancients admired the priſon of the tyrant. At preſent, the upper end of the winding paſſage is cloſed up; and it is ſo narrow, that, ſome years ago, the captain of an Engliſh veſſel found great difficulty to clamber up it. It cannot, however, be denied that this grotto may have been uſed for the ſervice aſcribed to it; and I can readily believe that it may have led Kircher to the invention of the ear-trumpet.—See Travels by Peter de la Valle, Ray and Brydone, *Delle antiche Siracuſe volume primo, che contiene i due libri da G. Bonanni—volume ſecondo, che contiene gli ſcrittori anteriori a Bonanni.* In Palermo 1717. fol. *Daniel Bartolo del ſuono e de' tremori harmonici.* Bonon. 1680, who examined this grotto as a naturaliſt. *J. P. D'Orville, Sicula.* Amſtelodami 1764. 2 vol. fol. i. p. 182. 194.

* Phonurgia nova. Campidonæ 1673. fol.

ſound to that of the rays of light, he was led to the idea of conveying the former, in the ſame manner as the latter, to a great diſtance, by means of an inſtrument. For this purpoſe, about twenty-four years before, he had cauſed to be conſtructed, in the Jeſuits' college at Rome, an ear-trumpet, through which the porter could communicate any thing he had to ſay to him, when he was in his apartment in the upper ſtory. This apparatus attracted the notice of many ſtrangers, who were aſtoniſhed at its effect. He here repreſents it as a proper ſpeaking-trumpet; and adds, that it excited much ſurpriſe, on account of the uncommon ſtrength which it gave to the voice. For this reaſon he was very deſirous of trying to what diſtance words could be diſtinctly conveyed by ſuch a tube; and an opportunity occurred of doing this the ſame year that he wrote his *Phonurgia*. From a convent, ſituated on the top of a mountain, he aſſembled twelve hundred perſons to divine ſervice, at the diſtance of from two to five Italian miles, and read the Litany through it. Soon after, the emperor cauſed a tube to be made according to Kircher's deſcription, by which, without elevating the voice, he could be underſtood from Eberſdorf to Neugebeu. But, though Kircher came ſo near to the invention of the ſpeaking-trumpet, it does not appear certain by his works that he attempted or conſtructed it before

fore Sir Samuel Morland. I ſhall now examine the evidences he adduces in his favour.

The moſt important of theſe is Schott, becauſe he publiſhed his *Magia Naturalis* * in 1657, before the invention of Sir Samuel Morland. All that is to be found in this work, however, relates alone to the ear-trumpet; a figure of which is added from the *Muſurgia*; but we here learn, with certainty, that Kircher then had the before-mentioned funnel or tube in his apartment. It is alſo not improbable that he had tried to anſwer the porter from his apartment; and that he had thereby remarked that the voice was ſtrengthened; for it is not proved by Schott that he at that time was acquainted with and had in his poſſeſſion a portable ſpeaking-trumpet.

Another author by whom Kircher endeavours to ſupport his claim is Harsdorfer; who, however, ſpeaks only of tubes to be cloſely applied to the mouth and to the ear, and who refers to the *Muſ-*

* This machine was invented by Kircher, in imitation of the Ear of Dionyſius; nor is it a vain and empty ſpeculation, for the machine produces an infallible effect. Kircher cauſed to be made at Rome, of tin plate, a very large and ſtraight tube, like a funnel, and placed it in an apartment next to his chamber, in ſuch a manner that the large end projected into the garden of the college, and the leſs entered his chamber. When the porter of the college had occaſion to call him to the gate, that he might not be obliged always to go up ſtairs, or to bawl out, he went to the broad end of the funnel and communicated what he wiſhed to Kircher. *Schotti Magia univerſalis naturæ et artis.* Herbipoli 1657—1659. 2 vol. 4to. ii. p. 156.

urgia, without mentioning the real ſpeaking-trumpet, though the ſecond part of his Mathematical Recreations was firſt printed in 1677, and the third in 1692 *. Beſides theſe teſtimonies, Kircher quotes alſo Eſchinard concerning ſound †. With that work I am not acquainted; but as the information it contains is taken from the *Muſurgia*, it is of as little importance as that of Derham ‡, who refuſes the invention to his countryman, and gives it to Kircher. When I unite all the evidence in favour of Kircher, it appears to be certain that he made known and employed the ear-trumpet earlier than the portable ſpeaking-trumpet; that he, however, approached very near to the invention of the latter, but did not cauſe one to be conſtructed before Sir Thomas Morland, to whom the honour belongs of having firſt brought it to that ſtate as to be of real uſe. Such, at leaſt, is the manner in which this diſpute is decided by the Jeſuit De Lanis §.

* Vol. ii. p. 152. and iii. p. 362.

† Eſchinardi Diſcurſus de ſono pneumatico, p. 10.

‡ Phyſico-theology.

§ Our Kircher, in his *Phonurgia*, juſtly claims that invention as it was ſeveral years ago exhibited by him in the Jeſuits' college at Rome, and an account of it printed. That this is true I myſelf was an eye-witneſs; though I muſt acknowledge that no one before the above-mentioned Engliſhman ever applied this ſpeaking inſtrument, at leaſt in ſo perfect a manner, to that uſe for which it was afterwards employed. *Magiſterium naturæ et artis.* Brixiæ 1684—1692. fol. ii. p. 436.

When

When Morland's invention was made known in France, it was pretended that Salar, an Auguſtine monk, had ſeven or eight years before cauſed ſuch tubes or trumpets to be made, in order to ſtrengthen the voice of a weak baſs ſinger; but he himſelf acknowledges that he never had an idea of ſpeaking with them at a diſtance *.

This inſtrument was ſoon made for ſale at Nuremberg, in Germany, particularly by that well-known artiſt Grundler, whom Becher † mentions, and who imagined that two perſons, by means of a ſpeaking-trumpet and an ear-trumpet, could converſe together at a great diſtance, without any one in the neighbourhood, or in the intermediate ſpace, hearing what they ſaid.

Of thoſe who employed their ingenuity in improving this inſtrument I ſhall mention the following. Caſſegrain, known on account of his optical inſtruments, publiſhed ſome hints for that purpoſe in 1672 ‡; as did Sturm §, Conyers ||, Haſe, and others afterwards ¶. The laſt who inveſtigated the theory of the ſpeaking-trumpet was

* Journal des ſçavans, tome iii.

† Narriſche Weiſheit, p. 37.

‡ Journal des ſçavans, ut ſupra, p. 131.

§ J. A. Sturm, Collegium experimentale ſive curioſum. Norimbergæ 1701. 4to. ii. p. 146.

|| Philoſoph. tranſact.

¶ Diſſert. de tubis ſtentoreis. Lipſiæ 1719.

Lambert *; according to whoſe ideas the figure of a ſhortened cone, if not the beſt, is at leaſt as good as any other that might be employed.

ANANAS.

No great ſkill in botanical phyſiognomy was neceſſary to diſcover the excellence of the Ananas. It recommended itſelf ſo much by its taſte, ſmell and colour, as to attract the notice of the firſt Europeans who viſited Braſil; and we find it praiſed in the earlieſt writers on America, who give an account of it, as well as of tobacco, maize, and other productions of the new world.

Gonçalo Hernandez de Oviedo is, as far as I know, the firſt perſon who deſcribed and delineated the ananas. This author was born at Madrid in 1478; went to America in 1513, and in 1535 was governor of St. Domingo. In the laſt-mentioned year, his General Hiſtory of America was printed at Seville. At that time three kinds were known, which in America were called *yayama*, *boniama*, and *yayagua*, but by the Spaniards *pinas*. Attempts had then been made to ſend the fruit to

* Mémoires de l'Académie des Sciences à Berlin, année 1763, p. 87. Compare alſo De la Chapelle's Treatiſe on conic ſections, tranſlated into German, with obſervations, by J. L. Bockmann. Carlsruhe 1771. 8vo. p. 217.

Spain

Spain by pulling it before it was ripe; but it had always become ſpoilt in the courſe of the voyage. Oviedo had tried alſo to ſend ſlips or young ſhoots to Europe, but theſe alſo died by the way. He, however, entertained hopes that means would be found to rear the ananas in Spain, in which maize or Turkiſh corn had been ſeen brought to maturity, provided it could be tranſported with ſufficient expedition *.

Geronimo Benzono, a Milaneſe, who reſided in Mexico from 1541 to 1555, cauſed, on his return, his Hiſtory of the new world to be printed, for the firſt time, at Venice in 1568. In this work he highly extols the pinas; and ſays, he believes that no fruit on the earth can be more pleaſant: ſick perſons, who loathed all other food, might reliſh it †.

After him, Andrew Thevet, a French monk, who was in Braſil from 1555 to 1556, deſcribed and delineated this plant under the name of *nanas*. The art of preſerving the fruit with ſugar was at that time known ‡.

John de Lery, who went to Braſil in 1557 as chaplain to a Huguenot colony, in the account of

* La hiſtoria general de las Indias. Sevilla 1535. fol. lib. xvii. c. 13.

† The Latin tranſlation is intitled *Novæ novi orbis hiſtoriæ libri tres.* Urb. Calvetonis *operâ Latini facti, et notis illuſtrati.*

‡ Les ſingularitez de la France antarctique, autrement nommée Amerique. Par André Thevet. A Anvers 1558.

his voyage firſt uſed the word *ananas*, which probably took its riſe from the *nanas* of Thevet *.

In the middle of the ſixteenth century, Franc. Hernandes, a naturaliſt, undertook an expenſive, and almoſt uſeleſs, voyage to Mexico. It coſt Philip II king of Spain 60,000 ducats, and the obſervations he collected, for which, at the time Acoſta was in America, 1200 figures were ready, were never completely printed; and in what are printed one can ſcarcely diſtinguiſh thoſe of the original author from the additions of ſtrangers. He has, however, given a ſomewhat better figure of the ananas, which he calls *matzatli* or *pinea Indica* †.

Chriſtopher Acoſta, in his treatiſe of the drugs and medicines of the Eaſt Indies ‡, printed in 1578, calls this plant the ananas. He ſays it was brought from Santa Cruz to the Weſt Indies, and that it was afterwards tranſplanted to the Eaſt Indies and China, where it was, at that time, common. The latter part of this account is confirmed

* Hiſtoire d'un voyage faict en la terre du Breſil, autrement dite Amerique. Par Jean de Lery. Geneve 1580. 8vo. p. 188. or Hiſtoria navigationis in Braſiliam, auctore Joanne Lerio. Excudebat Euſtat. Vignon. 1586. 8vo. p. 162.

† Rerum medicarum novæ Hiſpaniæ theſaurus. Romæ 1651. fol. p. 311. The ſame deſcription is to be found in Nierembergii Hiſtoria naturæ. Antverpiæ 1635. fol. p. 335.

‡ Tractado de las drogas y medicinas de las Indias Orientales. 4to.

by

by J. Hugo de Linſchotten, who was in the Eaſt Indies from 1594 to 1595 *.

Attempts were very early made, as Oviedo aſſures us, to tranſplant the ananas into Europe; and as in the beginning of the ſeventeenth century it was reckoned among the marks of royal magnificence to have orange-trees in expenſive hot-houſes, it was hoped that this fruit could be brought to maturity alſo in the artificial climate of theſe buildings. Theſe attempts, however, were every where unſucceſsful; no fruit was produced, or the fruit did not ripen, becauſe, perhaps, this favourite exotic was treated with too much care. It is not certainly known who in Europe firſt had the pleaſure of ſeeing ananas ripen in his garden; but it appears that ſeveral had that ſatisfaction at the ſame time in the beginning of the preſent century.

The German gardens in which the ananas was firſt brought to maturity appear to have been the following. Firſt, that of Baron de Munchauſen, at Schwobber, not far from Hameln, which on account of the botanical knowledge of its proprietor, and the abundance of plants it contains, is well

* The accounts given by Acoſta and Linſchotten may be ſeen in *Baubini Hiſtor. plantarum*, iii. p. 95. Kircher in his *China illuſtrata*, Amſtel. 1667, fol. p. 188, ſays, "That fruit which the Americans "and people of the Eaſt Indies, among whom it is common, call the "ananas, and which grows alſo in great abundance in the provinces of "Quantung, Chiamſi, and Fokien, is ſuppoſed to have been brought "from Peru to China."

known

known to all thoſe who are fond of botany. In the beginning of this century it belonged to Otto de Munchauſen, who, perhaps, was the firſt perſon who erected large buildings for the expreſs purpoſe of raiſing that fruit, and who had the noble ſatisfaction of making known their advantageous conſtruction. With this view he ſent a deſcription and plan of his ananas-houſes to J. Chriſtopher Volkamer, a merchant of Nuremberg, who inſerted them in his continuation of the Nuremberg Heſperides, printed there in 1714, and by theſe means rendered the attainment of this fruit common. This Baron de Munchauſen is the ſame who has been celebrated by Leibnitz: "All the "travellers in the world," ſays that great man, "could not have given us, by their relations, "what we are indebted for to a gentleman of this "country, who cultivates with ſucceſs the ananas, "three leagues from Hanover, almoſt on the "banks of the Weſer, and who has found out the "method of multiplying them, ſo that we may, "perhaps, have them one day as plentiful, of our "own growth, as the Portugueſe oranges, though "there will, in all appearance, be ſome deficiency "in the taſte *." As the Baron Munchauſen's garden at Schwobber was in the abſence of the proprietor, as Volkamer ſays, under the care of J. F.

* See Nouveaux eſſais ſur l'entendement humain, p. 256, in Oeuvres philoſophiques de M. de Leibnitz, publiés par Raſpe. Amſterdam 1765. 4to.

Berner,

Berner, canon of the cathedral of St. Boniface, he probably may have had ſome ſhare in rendering this ſervice to horticulture.

This fruit was produced alſo in the garden of Doctor Volkamer at Nuremberg, and in that of Doctor F. Kaltſchmid, at Breſlau, almoſt about the ſame time. The latter was ſo fortunate as to bring it to maturity ſo early as 1702, and he ſent ſome of it then for the firſt time to the imperial court *. At Francfort on the Mayne it was firſt produced in 1702 †; and at Caſſel in 1715, by the ſkill of Wurſtorfs, the head gardener.

Holland procured the firſt ripe ananas from the garden of De la Court, whom Miller calls Le Cour, in the neighbourhood of Leyden. As a great many plants were ſold out of this garden to foreigners, and as the Engliſh had theirs firſt from it, many are of opinion that Europe is indebted for the firſt poſſeſſion of this fruit to De la Court, and his gardener William de Vinck ‡.

I ſhall here take occaſion to mention a circumſtance which belongs alſo to the hiſtory of gardening. Before the cultivation of the ananas was introduced, the Dutch had begun to employ tanner's bark for making forcing-beds. From them

* Breſlauer Sammlung von Natur-Geſchichten, 1718, Septemb. p. 1618; and 1720, Septemb. p. 302.

† Lerſner, Chronik, ii. p. 824,

‡ Miller's Gardener's dictionary, i. p. 132. Lueder, Wartung der Küchengewachſe. Lubeck 1780. 8vo. p. 248.

the

the Engliſh firſt learned this improvement, and the firſt forcing-beds in England were made at Blackheath in Kent, in 1688, and employed for rearing orange-trees; but about the year 1719, much later than in Holland, ananas became more common, and forcing-beds were in much greater uſe *.

This plant, the hiſtory of which I have given, received from Plumier †, who firſt diſtinguiſhed its characteriſing marks, the name of *Bromelia*, after a Swediſh naturaliſt, whoſe remembrance deſerves to be here revived. Olof Bromelius was born in 1639, at Oerebro, where his father carried on trade. He ſtudied phyſic at Upſal, diſputed there in 1667 *de pleuritide*, and in 1668 taught botany at Stockholm. In 1672 he was phyſician to the embaſſy to England, and afterwards to that to Holland, where, in 1673, he received the degree of doctor at Leyden, and wrote a diſſertation *de lumbricis*. On his return to his native country, in 1674, he became a member of the college of phyſicians at Stockholm; but in 1691 he was city phyſician to Gottenburg, and provincial phyſician in Elfsburg and Bahus-Lan, in which ſituation he

* Miller, ii. p. 824. Lueder, p. 39. That putrid bark forms an excellent manure, had been before remarked by Lauremberg, *in Horticultura*, p. 52.

† Nova plantarum Americanarum genera. Pariſiis 1703. 4to, p. 46.

died

died in the year 1705. His botanical writings are *Lupologia*, and *Chloris Gothica* *. His ſon, Magnus von Bromel, is the author of *Lithographia Sue-cana* †.

SYMPATHETIC INK.

IF we give this name to any fluid which being wrote with, the letters, under certain circumſtances, or after a certain operation, will become conſpicuous and legible, ſuch liquids were known in very early periods. Among the methods which Ovid teaches young women to deceive their guardians, when they write to their lovers ‡, he mentions that of writing with new milk, and of making the writing legible by coal-duſt or ſoot. Auſonius propoſes the ſame means to Paulinus ‖; but

* Halleri Bibl. botan. i. p. 640.

† This account is taken from *Georg Gezelius Förſök til et biographiſkt Lexicon öfver lärde Svenſke män*, the firſt part of which was publiſhed at Stockholm in 1778. 8vo.

‡ Tuta quoque eſt, fallitque oculos, e lacte recenti
Litera: carbonis pulvere tange; leges.
De arte amandi, lib. iii. v. 629.

‖ Lacte incide notas; areſcens charta tenebit
Semper inadſpicuas; prodentur ſcripta favillis.
Auſonii Epiſt. xxiii. v. 21.

The poet afterwards teaches other methods of ſecret writing. Eneas, in Poliorceticis, cap. 31. and Gellius, lib. xvii. cap. 9. mention the like.

his

his commentators ſeem not to have fully underſtood his meaning; for *favilla* is not to be explained by *favilla non modice calida*, as Vinetus has explained it, but by *fuligo*. That word is often employed by the poets in the ſame ſenſe. As a proof of it, Columella, ſpeaking of the, not altogether ineffectual, and even ſtill uſed, method of preſerving plants from inſects by ſoot, calls it *nigra favilla*; and afterwards, when mentioning the ſame method, free from poetical fetters, he ſays *fuliginem quæ ſupra focos tectis inhæret* *. One may eaſily perceive, that inſtead of milk any other colourleſs and glutinous juice may be employed, as it will equally hold faſt the black powder ſtrewed over it. Pliny, therefore, recommends the milky ſap of certain plants for the like purpoſe †.

There are ſeveral metallic ſolutions perfectly colourleſs, or, at leaſt, without any ſtrong tint, which being wrote with, the letters will not appear until the paper be waſhed over with another colourleſs ſolution, or expoſed to the vapour of it; but among all theſe there is none which excites more aſtoniſhment, or from which naturaliſts can draw more concluſions, than that which conſiſts of a ſolution of lead in vegetable acid, and which by

* Colum. de re ruſt. x. 354. and xi. 3, 60. p. 773.

† Tithymalum noſtri herbam lactariam vocant, alii lactucam caprinam: narrantque lacte ejus inſcripto corpore, cum inaruerit, ſi cinis inſpergatur, apparere litteras; et ita quidam adulteras alloqui maluere quam codicillis. *Plin.* lib. xxvi. cap. 8. p. 400.

the

the vapour of arſenical liver of ſulphur becomes black, even at a conſiderable diſtance. This ink, which may be uſed by conjurers, proves the ſubtlety of vapour, and the poroſity of bodies; as the change or colouring takes place, even when the writing is placed on the other ſide of a thin wall.

This effect preſented itſelf perhaps accidentally to ſome chemiſt; but the diſcovery is not of great antiquity. Wecker, who compiled his book *de ſecretis* from Porta, Cardan, and ſeveral old writers, and printed it for the firſt time in 1582, and gave a third edition in 1592, muſt have been unacquainted with it; elſe he certainly would not have omitted it in the fourteenth book, where he mentions all the methods of ſecret writing. Neither would it have been unnoticed by Caneparius, whoſe book *de atramentis* was printed at Venice, for the firſt time, in 1619, in quarto.

The firſt perſon who, as far as I have been able to learn, gave a receipt for preparing this ink, was Peter Borel, in *Hiſtoriarum et obſervationum medico-phyſic. centuriæ quatuor.* In this work, which was printed, for the firſt time, in 1653, and a ſecond time in 1657, at Paris, and of which there were ſeveral editions afterwards, the author calls it a magnetic water, which acts at a diſtance *. After the

* The ſixth obſervation of the ſecond century is as follows: *Magnetic waters which act at a diſtance.* An aſtoniſhing effect, indeed, is produced

the occult qualities of the ſchoolmen were exploded, it was cuſtomary to aſcribe phenomena the cauſes of which were unknown, and particularly thoſe the cauſes of which ſeemed to operate without any viſible agency, to magnetic effluvia; as the turmalin was at firſt conſidered to be a kind of magnet. Others concealed their ignorance under what they called ſympathy, and in latter times attraction and electricity have been employed for the like purpoſe. Borel, who made it his buſineſs to collect new obſervations that were kept ſecret, learned the method of preparing this magnetic water from an ingenious apothecary of Mont-

produced by the conteſt of the following waters, which are thus made. Let quick-lime be quenched in common water, and while quenching, let ſome orpiment be added to it (this however ought to be done by placing warm aſhes under it for a whole day), and let the liquor be filtered, and preſerved in a glaſs bottle well corked. Then boil litharge of gold well pounded, for half an hour with vinegar, in a braſs veſſel, and filter the whole through paper, and preſerve it alſo in a bottle cloſely corked. If you write any thing with this laſt water, with a clean pen, the writing will be inviſible when dry; but if it be waſhed over with the firſt water it will become inſtantly black. In this, however, there is nothing aſtoniſhing; but this is wonderful, that though ſheets of paper without number, and even a board be placed between the inviſible writing and the ſecond liquid, it will have the ſame effect, and turn the writing black, penetrating the wood and paper without leaving any traces of its action, which is certainly ſurpriſing; but a fetid ſmell, occaſioned by the mutual action of the liquids, deters many from making the experiment. I am, however, of opinion, that I could improve this ſecret by a more refined chemical preparation, ſo as that it ſhould perform its effect through a wall. This ſecret I received, in exchange for others, from J. Broſſon, a learned and ingenious apothecary of Montpelier.

pelier, and in return taught him ſome other ſecrets. Otto Tachen, a German chemiſt*, afterwards thought of the ſame experiment, which he explains much better, without the aſſiſtance of magnetiſm or ſympathy. The receipt for making theſe liquids, under the name of ſympathetic ink, I find firſt given by Le Mort, in *Collectaneis chymicis Leydenſibus* †, and that name has been ſtill retained ‡.

Another remarkable kind of ſympathetic ink is that prepared from cobalt, the writing of which diſappears in the cold, but appears again of a beautiful green colour, as often as one chooſes, after being expoſed to a moderate degree of heat ||.

The invention of this ink is generally aſcribed to a Frenchman, named Hellot. He was, indeed, the firſt perſon who, after trying experiments with it, made it publicly known, but he was not the inventor; and he himſelf acknowledges that a German artiſt of Stolberg firſt ſhewed him a reddiſh

* Tachenii Hippocraticæ medicinæ clavis, p. 236. This work was twice printed in 1669, viz. at Venice and Francfort.

† Collectanea Chymica Leydenſia, id eſt, Mætſiana, Margraviana, Le Mortiana - - - edidit Chriſt. Love. Morley. Lugd. Bat. 1684. 4to. p. 97.

‡ For an account of various kinds of ſecret writing ſee *Halle, Magie oder Zauberkraſte der natur.* Berlin 1783. 8vo. v. i. p. 138.

|| The works which treat of this ink may be ſeen in Weigel's Chemie, p. 284.

ſalt, which, when expoſed to heat, became blue, and which he aſſured him was made out of Schneeberg cobalt, with aqua regia *. This account induced Hellot to prepare ſalts and ink from various minerals impregnated with cobalt; but A. Geſner proved, long after, that this ink is produced by cobalt only, and not by marcaſite †.

When Hellot's experiments were made known in Germany, it was affirmed that profeſſor H. F. Teichmeyer, at Jena, had prepared the ſame ink ſix years before, and ſhewn it to his ſcholars, in the courſe of his lectures, under the name of ſympathetic ink ‡. It appears, however, that it was invented, even before Teichmeyer, in the beginning of this century by a German lady. This is confirmed by Pot, who ſays that the authoreſs of a book printed in 1705, which he quotes under the unintelligible title of *D. J. W. in clave*, had given a proper receipt for preparing the abovementioned red ſalt, and the ink produced by it ‖.

I ſhould

* Hiſt. et Mémoires de l'Académ. des Sciences a Paris. Année 1737. pp. 101 and 228.

† J. A. Geſneri Hiſtoria cadmiæ foſſilis, ſive cobalti. Berolini 1744. 4to.

‡ This account, together with Teichmeyer's receipt for preparing it, may be found in Commercium litterarium Norimbergenſe, 1737. p. 91.

‖ Copioſius minera biſmuthi tam ab aqua forti quam ab aqua regia diſſolvitur, reſtante pulvere albo corroſo; ſolutio in aqua forti roſeum colorem ſiſtit, quæ ſi ſali in aqua ſoluto, ſecundum præſcriptum *D. J. W. in clave*, affundatur, abſtrahatur, ex reſiduo extrahitur ſal roſeum,

I ſhould be very glad if any one could give me information reſpecting this book, for I muſt confeſs that I am not able to conjecture what kind of a work it is. If it be true that Theophraſtus Paracelſus, by means of this invention, could repreſent a garden in winter, it muſt be undoubtedly older *.

DIVING-BELL.

THE firſt divers learned their art by early and adventurous experience, in trying to continue under water as long as poſſible without breathing †; and, indeed, it muſt be allowed that ſome of them carried it to very great perfection. This art, however, excites little ſurpriſe; for, like running, throwing, and other bodily dexterities, it requires only practice; but it is certain that thoſe nations called by us uncultivated and ſavage excell in it the Europeans ‡, who, through refinement and luxury,

roſeum, quod pulveriſari et cum ſpiritu vini extrahi poteſt: adeoque hæc autrix jam anno 1705 publice totum proceſſum et fundamentum ſic dicti atramenti ſympathetici, quod a calore virideſcit, evulgavit. *Pot, Obſervationum chymicarum collectio prima.* Berolini 1739. p. 163.

* So thinks Geſner in *Selecta phyſico-œconomica*, or *Sammlung von allerhand zur naturgeſchichte gehörigen begebenheiten.* Stutgard, vii. p. 22.

† Didicerunt quidam ad immenſam altitudinem mergi, ac ſine ulla reſpirandi vice perpeti maria. *Seneca de Ira*, ii. 12.

‡ Inſtances of the dexterity of the ſavages in diving and ſwimming

luxury, have become more delicate, and leſs fit for ſuch laborious exerciſes.

In remote ages, divers were kept in ſhips to aſſiſt in raiſing anchors *, and goods thrown overboard in times of danger †; and, by the laws of the Rhodians, they were allowed a ſhare of the wreck, proportioned to the depth to which they had gone in ſearch of it ‡. In war, they

may be ſeen in *Jens Kraft Sitten der wilden*, Kopenhagen 1766. 8vo. p. 39. To which may be added the account given by Maffæus of the Braſilians: "They are," ſays he, "wonderfully ſkilled in the art of diving, and can remain ſometimes for hours under water, with their eyes open, in order to ſearch for any thing at the bottom." *Hiſt. Indic.* lib. ii.

* ——————————— pugna fuit unus in illa
Eximius Phoceus animam ſervare ſub undis
Scrutarique fretum, ſi quid manſiſſet arenis,
Et nimis affixos unci convellere morſus,
Adductüm quotiens non ſenſerat anchora funem.
Lucanus, iii. 697.

† Per urinatores omne ferrum extractum eſt. *Livius*, xl. c. 10.

Corpora immergunt undis, ipſumque ſub antris
Nerea et æquoreas conantur viſere nymphas,
Exportantque maris prædas, et rapta profundo
Naufragia, atque imas avidi ſcrutantur arenas.
Manilii Aſtronom. v. 449.

‡ A Latin tranſlation of theſe laws may be found in *Marquard de jure mercatorum*, p. 338. "If gold or ſilver, or any other article be "brought up from the depth of eight cubits, the perſon who ſaves it "ſhall receive one third. If from fifteen fathoms, the perſon who "ſaves it ſhall, on account of the danger of the depth, receive one "half. If goods are caſt up by the waves, towards the ſhore, and "found ſunk at the depth of one cubit, the perſon who carries them "out ſafe, ſhall receive a tenth part." See alſo, *Scheffer de militia navali*, Upſaliæ, 4to. p. 110.

were

were often employed to deſtroy the works and ſhips of the enemy. When Alexander was beſieging Tyre, divers ſwam off from the city, under water, to a great diſtance, and with long hooks tore to pieces the mole with which the beſiegers were endeavouring to block up the harbour †. The pearls of the Greek and Roman ladies were fiſhed up by divers at the great hazard of their lives; and by the like means are procured at preſent thoſe which are purchaſed as ornaments by our fair.

I do not know whether obſervations have ever been collected reſpecting the time that divers can continue under water. Anatomiſts once believed that perſons in whom the oval opening of the heart (*foramen ovale*) was not cloſed up, could live longer than others without breathing, and could, therefore, be expert divers. Haller ‡, however, and others, have contradicted this opinion; as people who have had that opening have been ſoon ſuffocated, and as animals who have it not can live a long time under water: beſides, when that opening is perceptible in grown per-

† Præcipuum auxilium erat, qui procul hoſtium conſpectu ſubibant aquam, occultoque lapſu ad molem uſque penetrabant; falcibus palmites arborum eminentium ad ſe trahentes. *Curtius*, iv. c. 3. The ſame account is given by Arrian, *de Expedit. Alexandri M.* edit. Blancardi. Amſt. 1668. 8vo. lib. ii. p. 138. We are told by Thucydides, in his ſeventh book, that the Syracuſans did the ſame thing.

‡ Boerhaave, Prælectiones academicæ, edit. Halleri, Gottingæ 1774, 8vo. v. 2. p. 472—474. Halleri Elementa phyſiologiæ, edit. Lauſannæ 1761. 4to. iii. p. 252. and viii. 2. p. 4.

ſons, it is ſo ſmall as not to be ſufficient for that purpoſe, eſpecially as the *ductus arterioſus* is ſcarcely ever found open.

The divers of Aſtracan, employed in the fiſhery there, can remain only ſeven minutes under water *. The divers in Holland ſeem to have been more expert. An obſerver, during the time they were under water, was obliged to breathe, at leaſt, ten times †. Thoſe who collect pearl-ſhells in the Eaſt Indies, can remain under water a quarter of an hour ‡, though ſome are of opinion that it is poſſible to continue longer; and Merſenne mentions a diver, named John Barrinus, who could dive under water for ſix hours ||. How far this may be true, I ſhall leave others to judge; but it is certain, that men began very early to contrive means for ſupplying divers with air under the water, and of thereby enabling them to remain under it much longer.

For this purpoſe the diving-bell, *campana urina-*

* The divers of Aſtracan ſtepped from the warm bath into the water, in which they could not continue above ſeven minutes, and were brought back from the water, cold and benumbed, to the warm bath, from which they were obliged to return to the water again. This change from heat to cold they repeat five times a day, until, at length, the blood flows from their noſe and ears, and they are carried back quite ſenſeleſs. *Gmelins Reiſe durch Ruſsland*, ii. p. 199.

† Acta philoſophica ſocietatis in Anglia, auctore Oldenburgio. Lipſiæ 1675. 4to. p. 724.

‡ Oldenburg. ut ſupra.

|| Scheeps-bouw beſchreven door Nic. Witſen. Amſterdam 1671. fol. p. 288.

toria,

toria, was invented. Thoſe who had no idea of this machine, might have eaſily been led to it by the following experiment. If a drinking-glaſs inverted be immerſed in water, in ſuch a manner that the ſurface of the water may riſe equally around the edge of the glaſs, it will be found that the glaſs does not become filled with water, even when preſſed down to the greateſt depth; for, where there is air, no other body can enter, and by the above precaution the air cannot be expelled by the water. In like manner, if a bell of metal be conſtructed, under which the diver can ſtand on a ſtool ſuſpended from it ſo that the edge of the bell may reach to about his knee, the upper part of his body will be ſecured from water, and he can, even at the bottom of the ſea, breathe the air incloſed in the bell.

The invention of this bell is generally aſſigned to the ſixteenth century, and I am of opinion that it was little known before that period. We read, however, that even in the time of Ariſtotle divers uſed a kind of kettle to enable them to continue longer under the water *; but the manner in which

* Ἔοικε δέ, ὁμόιως ἀναπγοὴν ποιεῖσι τοῖς κολυμβητᾶις λέβητα καταφέντες. Ου πίμπλαται γὰρ ὗτος τοῦ ὕδατος, ἀλλὰ τηρεῖ τὸν ἀέρα. μετὰ βίας γὰρ ἡ κάθεσις. ὀρθον γὰρ ὁτιοῦν παρεγκλιδὲν εἰσρεῖ. *Ariſtot.* problem. xxxii. §. 5. *Thus tranſlated by Theodore Gaza*: Plerique lebete dimiſſo reſpirandi viam urinatoribus moliuntur; haud enim aqua lebes impletur, ſed aera ſervat ad demerſum hominem uſque; quippe qui erectus per vim dimittatur, ut undique æquali nutu deſcendat. Nam ſi

which it was employed is not clearly deſcribed, and the tranſlators have added many things not to be found in the original.

The oldeſt information we have reſpecting the uſe of the diving bell, in Europe, is that of John Taiſnier, quoted by Schott *. The former, who

quantumlibet inclinavit, humore protinus interrumpente impleatur neceſſe eſt. *The tranſlation of Septalius is however different.* Videtur ſimile quid viam reſpirationi natatoribus ſibi parantibus, dum lebetem capiti ſuo ſupraponunt ore deorſum verſo; non enim repletur id aqua, ſed aerem conſervat: ſit enim cum violentia poſitio illa, rectum enim quodcunque inclinatum, influit.

* Were the ignorant vulgar told that one could deſcend to the bottom of the Rhine, in the midſt of the water, without wetting one's clothes, or any part of one's body, and even carry a lighted candle to the bottom of the water, they would conſider it as altogether ridiculous and impoſſible. This, however, I ſaw done at Toledo, in Spain, in the year 1538, before the emperor Charles V. and almoſt ten thouſand ſpectators. The experiment was made by two Greeks, who taking a very large kettle, ſuſpended from ropes with the mouth downwards, fixed beams and planks in the middle of its concavity, upon which they placed themſelves, together with a candle. The kettle was equipoiſed by means of lead fixed round its mouth, ſo that when let down towards the water no part of its circumference ſhould touch the water ſooner than another, elſe the water might eaſily have overcome the air included in it, and have converted it into moiſt vapour. If a veſſel thus prepared be let down gently, and with due care, to the water, the included air with great force makes way for itſelf through the reſiſting fluid. Thus the men incloſed in it remain dry, in the midſt of the water, for a little while, until, in the courſe of time, the included air becomes weakened by repeated aſpiration, and is at length reſolved into groſs vapours, being conſumed by the greater moiſture of the water: but if the veſſel be gently drawn up, the men continue dry, and the candle is found burning. *Taiſneri Opuſcula de celerrimo motu*, quoted by Schott in his *Technica curioſa*; lib. vi. c. 9. p. 393.

was

was born at Hainault, in 1509, had a place at court under Charles V. whom he attended on his voyage to Africa. He relates in what manner he ſaw at Toledo, in the preſence of the Emperor and ſeveral thouſand ſpectators, two Greeks let themſelves down under water, in a large inverted kettle, with a burning light, and riſe up again without being wet. It appears that this art was then new to the Emperor and the Spaniards, and that the Greeks were cauſed to make the experiment in order to prove the poſſibility of it. After this period the uſe of the diving-bell ſeems to have become ſtill better known. It is deſcribed more than once in the works of Sir Francis Bacon, who explains its effects, and remarks that it was invented to facilitate labour under the water *.

In the latter part of the laſt century the diving-bell was ſometimes employed in great undertakings. When the Engliſh, in the year 1588,

* Excellent uſe may be made of this veſſel, which is employed ſometimes in labouring under water on ſunk ſhips, to enable the divers to continue longer under water, and to breathe, in turns, for a little while. It was conſtructed in this manner. A hollow veſſel was made of metal, which was let down equally to the ſurface of the water, and thus carried with it to the bottom of the ſea the whole air it contained. It ſtood upon three feet, like a tripod, which were in length ſomewhat leſs than the height of a man; ſo that the diver, when he was no longer able to contain his breath, could put his head into the veſſel, and, having breathed, return again to his work. *Franciſci Baconi Opera, latine tranſlata opera S. I. Arnoldi.* Lipſiæ 1694. fol.—*Novum organum.* lib. ii. § 50. p. 408. Bacon relates the ſame thing in his *Phænomena univerſi*, p. 702.

diſperſed

diſperſed the Spaniſh fleet, called the Invincible Armada, part of the ſhips went to the bottom, near the Iſle of Mull, on the weſtern coaſt of Scotland; and ſome of theſe, according to the account of the Spaniſh priſoners, contained great riches. This information excited, from time to time, the avarice of ſpeculators, and gave riſe to ſeveral attempts to procure part of the loſt treaſure. In the year 1665, a perſon was ſo fortunate as to bring up ſome cannon, which, however, were not ſufficient to defray the expences. Of theſe attempts, and the kind of diving-bell uſed, an account has been given by a Scotſman named Sinclair*; but Paſchius†, Leupold‡, and others aſcribe falſely the invention of this machine to that learned man. He himſelf does not lay claim to this honor; but ſays only, that he converſed with the artiſt, and meaſured the machine.

Some years after, attempts of the like kind were renewed. William Phipps, the ſon of a blackſmith, born in America, in 1560, and who had been brought up as a ſhip carpenter at Boſton, formed a project for ſearching and unloading a rich Spaniſh ſhip ſunk on the coaſt of Hiſpaniola;

* G. Sinclari Ars nova et magna gravitatis et levitatis. Roterodami 1669. 4to. p. 220. The deſcription of the diving-bell has been tranſcribed from this work into Sturm's *Collegium curioſum*. Norimbergæ 1701. 4to.

† Paſchii Inventa nov-antiqua. Lipſiæ 1700. 4to. p. 650.

‡ Theatri ſtatici univerſalis pars tertia. Lipſiæ 1726. fol. p. 242.

and

and repreſented his plan in ſuch a plauſible manner, that King Charles II. gave him a ſhip, and furniſhed him with every thing neceſſary for the undertaking. He ſet ſail in the year 1683; but, being unſucceſsful, returned again in great poverty, though with a firm conviction of the poſſibility of his ſcheme. He endeavoured, therefore, to procure another veſſel from James II. who was then on the throne: but as he failed in this, he tried to find the means of executing his deſign by the ſupport of private perſons, and, according to the prevailing practice, opened for that purpoſe a ſubſcription. At firſt he was laughed at; but, at length, the Duke of Albemarle, ſon of the celebrated general Monk, took part in it, and advanced a conſiderable ſum to enable him to make the neceſſary preparations for a new voyage. Phipps ſoon collected the remainder; and in 1687 ſet ſail in a ſhip of two hundred tons burden, to try his fortune once more, having previouſly engaged to divide the profit according to the twenty ſhares of which the ſubſcription conſiſted. At firſt, all his labor proved fruitleſs; but at laſt, when his patience was almoſt entirely exhauſted, he was ſo lucky as to bring up, from the depth of ſix or ſeven fathoms, ſo much treaſure that he returned to England with the value of two hundred thouſand pounds ſterling. Of this ſum he himſelf got about ſixteen, others ſay twenty thouſand, and the Duke ninety thouſand pounds. After

he

he came back, ſome perſons endeavoured to perſuade the king to ſeize both the ſhip and the cargo, under a pretence that Phipps, when he ſolicited for his Majeſty's permiſſion, had not given accurate information reſpecting the buſineſs. But the King anſwered, with much greatneſs of mind, that he knew Phipps to be an honeſt man, and that he and his friends ſhould ſhare the whole among them, had he returned with double the value. His Majeſty even conferred upon him the honor of knighthood, to ſhew how much he was ſatisfied with his conduct. This Phipps was afterwards high ſheriff of New England, and died at London, greatly reſpected, in 1693. This affair was attended with ſuch good conſequences to the Duke of Albemarle that he obtained from the King the governorſhip of Jamaica, in order to try his fortune with other ſhips ſunk in that neighbourhood. But whether it was that the gold had been already all taken from the one before mentioned, or that, when the veſſel went to pieces, the ſea had diſperſed the cargo, it is certain that nothing farther was found worth the labour of ſearching for it *.

In England, however, ſeveral companies were formed, and obtained excluſive privileges of fiſhing up goods on certain coaſts, by the means of divers.

* This account is taken from The Hiſtory of the Britiſh Empire in America, by J. Wynne, London 1770. 2 vol. 8vo. i. p. 131, and from Campbell's Lives of the Admirals.

The

The moſt conſiderable of theſe was that which, in 1688, tried its ſucceſs at the Iſle of Mull, and at the head of which was the Earl of Argyle. The divers went down to the depth of ſixty feet under water, remained there ſometimes a whole hour, and brought up gold chains, money and other articles, which, however, when collected, were of very little importance*.—Without giving more examples of the uſe of the diving bell, I ſhall now mention ſome of thoſe who, in later times, have endeavoured to improve it. That this machine was very little known in the firſt half of the ſixteenth century I conclude from the following circumſtance. To the oldeſt edition of Vegetius on the art of war, there are added, by the editor, ſome figures of which no explanation is given in the book. Among theſe is repreſented a method of catching fiſh with the hands, at the bottom of the ſea. The apparatus for this purpoſe conſiſts in a cap, which is fitted ſo cloſely to the head of the diver that no water can make its way between; and from the cap there ariſes a long leather pipe, the opening of which floats on the ſurface of the water. Had the perſon who drew theſe figures been acquainted with the diving-bell, he would certainly have delineated it rather than this uſeleſs ap-

* Martin's Deſcription of the Weſtern Iſlands. The ſecond edition. London 1716. 8vo. p. 253. Campbell's Political Survey of Britain. London 1774. 2. vol. 4to. p. 604.

paratus

paratus *. Of the old figures of a diving machine, that which approaches neareſt to the diving bell is in a book on fortification, by Lorini; who deſcribes a ſquare box bound round with iron, which is furniſhed with windows, and has a ſtool affixed to it for the diver. This more ingenious contrivance appears, however, to be older than that Italian; at leaſt he does not pretend to be the inventor of it †.

In the year 1617, Francis Keſſler gave a deſcription of his water-armour ‡, intended alſo for diving, but which cannot really be uſed for that purpoſe §. In the year 1671, Witſen taught, in a better manner than any of his predeceſſors, the conſtruction and uſe of the diving bell ‖; but he is much miſtaken when he ſays that it was invented at Amſterdam. In 1679 appeared, for the firſt time, Borelli's well known work *de motu ani-*

* Theſe figures are to be found in the following editions: Fl. Vegetii Renati de re militari. Lutetiæ apud C. Wehelum 1532. fol. p. 180. Flavii Feget. Renati vier bucher von der Rytterſchafft. Gedrukt, yn der loblichen ſtat Erfurt, durch Hanſſen Knappen, 1511. fol. mit monchsſchrift.—Theſe figures are inſerted alſo in Leupold's *Theatrum pontificale*, p. 11. tab. ii. fig. 6.

† Le fortificationi di Bounaiuto Lorini, nuovamente riſtampata. In Venetia 1609. fol. p. 232. Lorini funf bucher von Beſtung bauwen, ubergeſetſt von David Wormbſer. Frankfurt 1607. fol. p. 201.

‡ Fran. Keſsleri Secreta. Oppenheim 1617. 8vo. nebſt kupfertafeln.

§ Bartholini Acta Hafn. 1676. p. i. obſ. 17.

‖ Scheeps-bouw, ut ſupra.

malium *, in which he not only deſcribed the diving bell, but alſo propoſed another, the impracticability of which was ſhewn by James Bernoulli †. When Sturm publiſhed his *Collegium curioſum* in 1678, he propoſed ſome hints for the improvement of this machine, on which remarks were made in the *Journal des ſçavans* ‡. None, however, have carried their reſearches further for this purpoſe than Dr. Halley, and Triewald a Swede.

The bell which Edmund Halley, ſecretary to the royal ſociety, cauſed to be made, was three feet broad at the top, five feet at the bottom, and eight feet in height; forming a cavity of ſixty-three cubic feet. It was covered with lead; and was ſo heavy that it ſunk to the bottom, even when entirely empty. Around the lower edge, weights were diſpoſed in ſuch a manner that it ſhould always ſink in a perpendicular direction, and never remain in an oblique poſition. In the top was fixed a piece of ſtrong glaſs to admit the light from above, and likewiſe a valve to give a paſſage to the air corrupted by the breath. Around

* I have before me, from the library of profeſſor Hollmann, the edition printed at the Hague, 1743, in quarto, in which the deſcription alluded to may be found, i. p. 222. It perhaps may be agreeable to many to know that this whole work is printed in *Magneti Bibliotheca anatomica*. Genev. 1669. 2 vol. fol.

† Acta eruditorum, 1683 Decemb. p. 553. *Jac. Bernoulli* Opera.

‡ Journal des ſçavans, 1678, Jan.

the

the whole circumference of the bottom was placed a ſeat, on which the divers ſat; and a ſtool, fixed to ropes, hung below, on which they could ſtand in order to work. The whole machine was ſuſpended from a croſs beam made faſt to the maſt of a ſhip, ſo that it could be eaſily lowered down into the water and again drawn up. That the bell might be ſupplied with freſh air, under the water, large veſſels filled with air, and which had an opening below through which the water compreſſed the included air, were let down by ropes. In the top of theſe veſſels were leather pipes, beſmeared with oil, through which the diver introduced air from the veſſels into the bell; and as ſoon as the veſſel was emptied, it was drawn up, on a ſignal made by the diver, and another let down. The foul air in the bell, being the warmeſt and lighteſt, aroſe to the top of the machine, where it was ſuffered to eſcape through the valve before mentioned. By theſe means the bell could be continually ſupplied with freſh air, in ſuch abundance, that Halley, and four other perſons, remained under water, at the depth of ten fathoms, an hour and a half, without ſuffering the leaſt injury, and could, with equal ſecurity, have continued longer, or even as long as they might have wiſhed. This precaution, however, is neceſſary, that the bell be let down at firſt very ſlowly, that the divers may be gradually accuſtomed to inſpire the compreſſed air; and at every twelve

twelve fathoms the bell muſt be held faſt, in order to expel the water which has ruſhed in, by letting freſh air into it. By ſuch apparatus, Halley was enabled to make the bottom of the ſea, within the circumference of the bell, ſo dry that the ſand or mud did not riſe above his ſhoe. Through the window, in the top, ſo much light was admitted, that when the ſea was ſtill, and the waves did not roll, he could ſee perfectly well to read and write under the water. When the empty air veſſels were drawn up, he ſent up with them his orders, written with an iron ſpike on a plate of lead, and could thus let thoſe above know when he wiſhed to be removed with the bell to another place. In bad weather, and when the ſea was rough, it was as dark under the bell, as at night; he then kindled a light; but a burning candle conſumed as much air as a man. The only inconvenience of which Halley complained was, that, in going down, he felt a pain in his ears, as if a ſharp quill had been thruſt into them. This pain returned every time the bell was let down to a greater depth, but ſoon went off again. A diver thought to prevent this pain by putting chewed paper into both his ears; but the bits of paper were forced in ſo far by the air, that a ſurgeon found great difficulty to extract them. That he might be able to ſend a diver to the diſtance of ſeveral fathoms from the bell on the bottom of the ſea, Halley invented a leaden cap, which covered the diver's head. This cap had

glaſs before it, contained as much air as was ſufficient for two minutes, and had affixed to it a thick pliable pipe, with the other end faſtened to the bell, and which, at the cap, was furniſhed with a valve to convey freſh air to the diver from the bell. This pipe, which the diver was obliged to wind round his arm, ſerved him alſo as a guide to find his way back to the bell *.

The laſt improvement of the diving-bell is by the well-known Triewald, a Swede. His bell, which was much ſmaller and more commodious, was made of copper, tinned in the inſide. On the top there were panes of glaſs, which, for the greater ſecurity, were fixed in a frame of the ſame metal. The ſtool below was placed in ſuch a manner, that the head only of the diver, when he ſtood upon it, roſe above the ſurface of the water in the bell. This ſituation is much better than when the whole body is raiſed above the water in the bell, becauſe near the ſurface of the water the air is much cooler and fitter to breathe in than at the top of the machine. That the diver alſo might remain conveniently in the upper part of the bell, Triewald arranged his apparatus ſo that when the diver had breathed as long as poſſible in the upper air, he found at the ſide of the bell a ſpiral pipe, through which he could draw in the lower cool air which

* Philoſophical Tranſact. 1717 and 1721. The art of living under water, by Halley.

was

was over the ſurface of the water. To the upper end of this copper pipe was affixed a pliable leather one, with an ivory mouth-piece which the diver put into his mouth, and could thus inſpire freſh air, in whatever poſition his body might be *.

An Engliſhman invented alſo a complete apparatus of ſtrong thick leather, which contained half a hogſhead of air. It was ſo prepared, that no air could eſcape through it; was conſtructed in ſuch a manner that it exactly fitted the arms and legs, and had glaſs placed in the forepart of it. When he put on this apparatus, he could not only walk on the ground at the bottom of the ſea, but alſo enter the cabin of a ſunk ſhip, and convey goods out of it at pleaſure. The inventor carried on this buſineſs for more than forty years, and acquired by it conſiderable property †.

COLOURED GLASS. ARTIFICIAL RUBIES.

IT is probable that there was no great interval between the diſcovery of the art of making glaſs, and that of giving it different colours. When the

* Philoſophical Tranſact. 1736.—Martin Triewald's Konſt at lefwa under watnet. Stockholm 1741. 4to.

† Martin's Philoſophia Britannica.

ſubſtance of which it is formed contains, by accident, any metallic particles, the glaſs aſſumes ſome tint; and this happens oftener than is wiſhed; nay a conſiderable degree of foreſight is neceſſary to produce glaſs perfectly colourleſs, and I am of opinion that this ſkill has not been attained till a late period in the progreſs of the art. Even in Pliny's time the higheſt value was ſet upon glaſs entirely free from colour, and tranſparent, or, as it was called, cryſtal *. From the different colours which glaſs acquired of itſelf, it was eaſy to conceive the idea of giving it the tinge of ſome precious ſtone: and this art, in ancient times, was carried to a very great extent. Proofs of this may be found in Pliny †, who, among others, mentions artificial hyacinths, ſapphires, and that black glaſs which approached very near to the obſidian ſtone, and which in more than one place he calls *gemmæ vitreæ* ‡. Trebellius Pollio relates in how whim-

* Maximus tamen honos in candido tranſlucentibus, quamproxima chryſtalli ſimilitudine. *Plin.* lib. xxxvi. c. 26.

† Ibid.

‡ Lib. xxxv. c. 26. and lib. xxxvii. c. 9. The *lapis obſidianus*, which Obſidius firſt found in Ethiopia, and made known, is undoubtedly the ſame as that vulcanic glaſs which is ſometimes called Icelandic agate, *pumex vitreus*, and by the Spaniards, who brought it from America and California, known by the name of *galinace*. Thick pieces of it are opake, but thin pieces are tranſparent. The colour of it is generally very black, but in thin pieces it is only blackiſh and almoſt like the dark topaz. Sometimes it is alſo blue, which is often the caſe in the Venetian. On the ſea-coaſt near Algiers, ſome pieces of it are found green. The Carpathian mountains produce all kinds of it. See my *Phyſikaliſch-ökon. biblioth.* iv. p. 29. v. p. 214. and vi. pp. 182, 371.

ſical

ſical a manner Gallienus puniſhed a cheat who had ſold to his wife a piece of glaſs for a jewel * : and. Tertullian ridicules the folly of paying as dear for coloured glaſs as for real pearls. The glaſs-houſes at Alexandria were celebrated among the ancients for the ſkill and ingenuity of the workmen employed in them. From theſe the Romans, who did not acquire a knowledge of that art till a late period, procured for a long time all their glaſs ware. The learned author of *Recherches ſur les Egyptiens et les Chinois*, in the end of his firſt volume, relates more of theſe glaſs-houſes than I know where to find in the works of the ancients; but it is certain that coloured glaſs was made even in thoſe early ages. The emperor Adrian received as a preſent from an Egyptian prieſt, ſeveral glaſs cups which ſparkled with colours of every kind, and which, as coſtly wares, he ordered to be uſed only on grand feſtivals†. Strabo tells us, that a glaſs-maker in Alexandria informed him that an earth was found in

* Idem, cum quidam gemmas vitreas pro veris vendidiſſet ejus uxori, atque illa, re prodita, vindicari vellet, ſurripi quaſi ad leonem venditorem juſſit, deinde e cavea caponem emitti: mirantibuſque cunctis rem tam ridiculam, per curionem dici juſſit, *Impoſturam fecit et paſſus eſt*; deinde negotiatorem dimiſit. *Hiſtoriæ Auguſtæ ſcriptores, in vita Gallieni*, cap. 12.

† Adrian in his letter writes as follows: Calices tibi allaſſontes verſicolores tranſmiſi, quos mihi ſacerdos templi obtulit, tibi et ſorori meæ ſpecialiter dedicatos, quos tu velim feſtis diebus conviviis adhibeas. *Vopiſcus in vita Saturnini*, c. 8.

Egypt, without which the valuable coloured glaſs could not be made *.

Seneca, in his ninetieth epiſtle, in which he judges too philoſophically, that is, with too little knowledge of the world, of the value of labour, mentions one Democritus who had diſcovered the art of making artificial emeralds †; but in my opinion this diſcovery conſiſted in giving a green colour by cementation to the natural rock cryſtal: and this art I imagine was treated of in that book, the name of which Pliny, through immoderate care leſt the deception ſhould become common, does not mention ‡. For colouring cryſtal and

* Εἶναι τινα καὶ κατ' Αἴγυπτον ὑαλίτιν γῆν, ἧς χωρὶς οὐχ οἷόν τε τας πολυχρόνους καὶ πολυτελεῖς κατασκευὰς ἀποτελεσθῆναι. Strabo. Amſtelod. apud Wolters 1707. fol. lib. xvi. p. 1099.——Some conſider the glaſs earth here mentioned as a mineral alkali, that was really found in Egypt, and which ſerved to make glaſs; but, as the author ſpeaks here expreſsly of coloured glaſs, I do not think that the above ſalt, without which no glaſs was then made, is what is meant; but rather a metallic earth, ſuch perhaps as ochre or manganeſe.

† Excidit porro vobis eundem Democritum inveniſſe quemadmodum ebur poliretur, quemadmodum decoctus calculus in ſmaragdum converteretur, qua hodieque coctum inventi lapides coctiles colorantur. Edit. Lipſii, p. 579.

‡ Quin immo etiam extant commentarii auctorum, quos non equidem demonſtrarim, quibus modis ex chryſtallo tinguntur ſmaragdi, aliæque tranſlucentes, ſardonix e ſarda, etiam ceteræ ex aliis. Neque eſt ulla fraus vitæ lucroſior. Lib. xxxvii. c. 12. A paſſage in Diodorus Siculus, lib. ii. c. 52. alludes in my opinion to this method of colouring by cementation.

glaſs, ſo as to reſemble ſtones, Porta *, Neri †, and others have, in modern times, given directions which are, however, not much uſed, becauſe the cryſtal is thereby liable to acquire ſo many flaws that it cannot be eaſily cut afterwards, though, as Neri aſſures us, theſe by attention may ſometimes be avoided.

It is worthy of remark, that in ſome collections of antiquities at Rome, there are pieces of coloured glaſs which were once uſed as jewels. In the *Muſeum Victorium*, for example, there are ſhewn a chryſolite and an emerald, both of which are ſo well executed that they are not only perfectly tranſparent and coloured throughout, but neither externally nor internally have the ſmalleſt blemiſh; which certainly could not be guarded againſt without great care and ſkill ‡.

What materials the ancients uſed for colouring glaſs, has not been told to us by any of their writers. It is, however, certain that metallic calces only can be employed for that purpoſe, becauſe theſe pigments withſtand the heat of the glaſs furnaces; and it is highly probable that ferruginous earth, if not the ſole, was at leaſt the principal ſubſtance by which not only all ſhades

* Magia naturalis. Franc. 1591. 8vo. p. 275.

† Kunkel's Ars vitraria. Nuremberg, 1743. 4to. pp. 98, 101.

‡ Diſſertatio glyptographica, ſive Gemmæ duæ vetuſtiſſimæ-- quæ extant Romæ in Muſeo Victorio. Romæ 1739. 4to. pp. 105, 106.

of red, violet, and yellow, but even a blue colour, could be communicated, as profeſſor Gmelin has ſhewn *. Reſpecting the red, of which only I mean here to ſpeak, there is the leſs doubt, as, at preſent, ſometimes an artificial, and ſometimes a natural, iron ochre is often employed for that purpoſe. For common works this is ſufficient; but when pure clear glaſs, coloured ſtrongly throughout with a beautiful lively red, free from flaws and in ſomewhat large pieces, is required, iron is not fit, becauſe its colour, by the continued heat neceſſary for making glaſs, either diſappears or becomes dirty and almoſt blackiſh †.

In the laſt century, ſome artiſts in Germany firſt fell upon the method of employing gold, inſtead of iron, and of thereby making artificial rubies, which when they were well ſet could deceive the eye of a connoiſſeur, unleſs he tried them with a diamond or a file. The uſual method was to diſſolve the gold in aqua regia, and to precipitate it by a ſolution of tin, when it aſſumed the form of a purple-coloured powder. This ſubſtance, which muſt be mixed with the beſt flint,

* De cæruleo materiarum vitro æmularum in antiquis monumentis obviarum colore, in Commentationibus Societ. Scient. Gottingenſis, ii. p. 41. A Tranſlation of this diſſertation may be ſeen in the fifth part of Crell's Chemical Journal.

† Montamy von den farben zum porzellan- und email-malen. Lipſic 1767. 8vo. p. 82. Fontanieu, p. 16.

is called the precipitate, or gold-calx, of Caſſius, gold-purple, or mineral purple *.

This Caſſius, from whom it takes its name, was called Andrew, and becauſe both his father and ſon had the ſame chriſtian name, they have been often confounded with each other. The father was ſecretary to the duke of Schleſwig, and is not known as a man of letters: but the ſon is celebrated as the inventor, or preparer of the gold-purple, and of a bezoar-eſſence. He took the degree of doctor at Leyden, in 1632, practiſed phyſic at Hamburgh, and was appointed phyſician in ordinary to the biſhop of Lubec. As far as I know, he never publiſhed any thing reſpecting his art; but this ſervice was rendered to the public by his ſon, who was born at Hamburgh, and reſided as a phyſician at Lubec. He was the author of a well-known treatiſe, now exceedingly ſcarce, entitled: *Thoughts concerning that laſt and moſt perfect work of nature, and chief of metals, gold, its wonderful properties, generation, affections, effects, and fitneſs for the operations of art; illuſtrated by experiments* †.

From

* Some excellent remarks reſpecting the preparation of this gold-purple, which is rather difficult, may be found in *L'art de faire les criſtaux colorés imitans les pierres précieuſes, par M. Fontanieu*, Paris 1778, 8vo. p. 11. *Lewis, Zuſammenhang der künſte. Zürich* 1764, 8vo. i. p. 276. *Baume, Experimental Chemie*, iii. pp. 87, 109, 309. The latter gives a different method of preparing the gold, which he calls reducing it to a calx by quick-ſilver.

† The original title runs thus: De extremo illo et perfectiſſimo naturæ

From this work it will be eaſily underſtood why the author does not give himſelf out as the inventor of the gold-purple *, which he is commonly ſuppoſed to be, at which Lewis is much aſtoniſhed. One will ſee alſo by it that Leibnitz calls him improperly a phyſician at Hamburgh, having probably confounded the father and ſon together †. Upon the whole, it is not proved that any of the Caſſius's was the inventor of the above precipitate, elſe it would certainly not have been omitted ‡ in this treatiſe; and mention of gold-purple is to be found in the works of ſeveral old chemiſts §.

Something of this kind has, doubtleſs, been meant by the old chemiſts, when they talk of red lions, the purple ſoul of gold, and the golden mantle; but what they wiſhed to conceal under theſe metaphors, I am not able to conjecture. In

turæ opificio ac principe terrenorum ſidere, auro, et admiranda ejus natura, generatione, affectionibus, effectis, atque ad operationes artis habitudine, cogitata; experimentis illuſtrata. Hamburgi 1685. 8vo.

* John Molleri Cimbria literata. Havniæ 1774. fol. i. p. 88.

† Miſcellanea Berolinenſia, i. p. 94.

‡ We find nothing more than the following words: *Eſt tamen modus adhuc alius, quique hactenus ſecretior fuit, quo, per ſingularem auri mediante liquore Jovis præcipitationem, ſulphur ejus fixum eleganter extravertitur.* The author ſhews only, in a brief manner, in how many ways this precipitate can be uſed: but he makes no mention of the employing it in colouring glaſs.

§ I cannot, however, affirm that the *vaſa murrhina* of the ancients were a kind of porcelain coloured with this calx of gold. This is only a mere conjecture, to be ſeen in *Oeuvres de M. Boſc d'Antic.* Paris 1780. 2 vol. 12mo. i. p. 230.

the

the year 1606, when Libavius publiſhed his Alchemy, the art of making ruby-glaſs muſt have been unknown. He indeed quotes an old receipt for making rubies; and conjectures, that becauſe the real ſtones of the ſame name are found in the neighbourhood of gold mines, they may have acquired their colour from that metal; and that, by means of art, glaſs might be coloured by a ſolution of gold *. The later chemiſts, however, and particularly Achard, found no traces of gold, but of iron, in that precious ſtone †. The idea which Libavius conceived from a falſe deduction, has nevertheleſs been confirmed by experience.

Neri, who lived almoſt at the ſame time as Libavius ‡, was better acquainted with the gold-purple, though his receipt is very defective. According to his directions, the gold ſolution muſt be evaporated, and the remains ſuffered to continue

* Rubini frequentes ſunt circa montem piniferum, ubi et auri venæ. Conſentaneum eſt, principia auri ibi degenerare in hanc gemmam. Ex tinctura auri rubea in liquorem ſeu oleum ſoluta, et chryſtalli liquore potiſſimum, non incommode fieri poſſe judicaverim. *Alchymia Andreæ Libavii.* Franc. 1606. fol. ii. tract. i. c. 34. p. 88.

† See Gotting. Gel. Anzeigen, 1778. p. 177.

‡ It is well known that Neri's works are tranſlated into Kunkel's *Ars vitraria*; the edition of which publiſhed at Nuremberg in 1743 I have in my poſſeſſion. The time Neri lived is not mentioned in the Dictionary of Learned Men; but it appears, from the above edition of Kunkel, that he was at Florence in 1601, and at Antwerp in 1609. The oldeſt Italian edition of his works I have ever ſeen is *L'arte vetraria—del R. P. Antonio Neri, Fiorentino.* In Venetia, 1663. The firſt edition, however, muſt be older.

over

over the fire until they become of a purple colour. One may readily believe that this colour will be produced; but glaſs will ſcarcely be coloured equally through by this powder, and perhaps ſome of the gold particles will ſhew themſelves in it. Kunkel affirms, and not without reaſon, that ſomething more is neceſſary to make rubies by means of gold; but he has not thought proper to tell us what it is *.

Glauber, who wrote his *Philoſophical Furnace* † about the middle of the laſt century, appears to have made ſeveral experiments with the gold-purple. He diſſolved the metal in aqua-regia; precipitated it by liquor of flint, and melted into glaſs the precipitate, which contained in it abundance of vitreous earth ‡.

None, however, in the laſt century, underſtood better the uſe and preparation of gold-purple than John Kunkel, who, after being ennobled by Charles XI, king of Sweden, aſſumed the name of Lewenſtiern. He himſelf tells us, that he made artificial rubies in great

* Neri, b. vii. c. 129. pp. 157 and 174.

† I am acquainted with the Amſterdam Latin edition of 1651, in four ſmall volumes, octavo, where the paſſage to which I allude is to be found in vol. iv. p. 78. In the common German edition, *Glauberi Opera Chymica*, Franc. 1658 and 1659, 2 vol. quarto, it is in vol. ii. pp. 125, 243. Lewis ſays, that *Furnus Philoſophicus* was printed as early as 1648.

‡ Glauber firſt made known liquor of flint, and recommended it for ſeveral uſes, as Ettmuller ſays in *Collegium pharmaceut.* See *M. Ettmulleri Opera*, Genevæ 1736, 4 vol. fol. ii. p. 170.

abundance,

abundance, and ſold them, by weight, at a high price. He ſays, he made for the elector of Cologne a cup of ruby glaſs, weighing not leſs than twenty-four pounds, which was a full inch in thickneſs, and of an equal beautiful colour throughout. He employed himſelf moſt on this art after he engaged in the ſervice of Frederic William elector of Brandenburg, in the year 1679. At that time he was inſpector of the glaſs-houſes at Potſdam; and, in order that the art of making ruby-glaſs might be brought to perfection, the elector expended 1600 ducats. A cup with a cover, of this manufacture, is ſtill preſerved at Berlin *. Kunkel, however, has no where given a full account of this art. He has only left in his works a few ſcattered remarks, which Lewis has collected †.

In the year 1684, earlier than Caſſius, John Chriſtian Orſchall wrote his well-known work *Sol ſine veſte* ‡, in which he treats, more intelligibly than any one before him, of the manner of making ruby-glaſs. He, however, confeſſes that Caſſius firſt taught him to precipitate gold by means of tin; that Caſſius traded in glaſs coloured

* Nicolai Beſchreibung der Reſidenzſtädte Berlin und Potſdam, ii. p. 993.

† Lewis, Zuſammenhang der Künſte. Zürich 1764. 2 vol. octavo, i. p. 279.

‡ The firſt edition was printed at Augſburg, in duodecimo, and the ſame year at Amſterdam. It has been often printed ſince, as in 1739, in three vol. quarto, without name or place.

with

with this precipitate, and that a good deal of coloured glaſs was then made at Freyſingen, but that the art was kept very ſecret. As Orſchal deſerves that his fate ſhould be better known, I ſhall here mention the following few particulars reſpecting him. About the year 1682 he was at Dreſden, in the ſervice of John Henry Rudolf, from whom he learned many chemical proceſſes, and particularly amalgamation, by which he gained money afterwards in Bohemia. After this he was employed in the mines in Heſſe; but he brought great trouble upon himſelf by polygamy and other irregularities, and died in a monaſtery in Poland *.

Chriſtopher Grummet, who was Kunkel's aſſiſtant, wrote, in oppoſition to Orſchal, his known treatiſe *Sol non ſine veſte*, which was firſt printed at Rothenburg, in 1685, in duodecimo †. In like manner, an anonymous author printed againſt Orſchal, at Cologne in 1684, another work, in duodecimo, entitled *Apelles poſt tabulam obſervans maculas in Sole ſine veſte*. The diſpute, however, was not ſo much concerning the uſe of gold-purple, as the cauſe of the red colour, and the vitrifying of gold.

* So we are told in *J. H. Rudolf's Dreſdenſis Elementa Amalgamationis*, firſt printed at Arnſtadt in 1712.

† A French tranſlation of Orſchal and Grummet is added to *l'Art de la verrérie de Neri, Merret et Kunkel*. Paris 1752. 4to. The editor is the Baron de Holbach, who, however, has not put his name to the work.

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It is worthy of remark, that Kunkel affirms he could give to glaſs a perfect ruby-red colour without gold; which Orſchal and moſt chemiſts have however doubted. It is nevertheleſs ſaid, that Kruger, who was inſpector of the glaſs-houſes at Potſdam, under Frederic William king of Pruſſia, diſcovered earlier the art of making ruby-glaſs without gold, and that a cup and cover of cut glaſs made in this manner is ſtill preſerved at Berlin *.

Painting on glaſs and in enamel, and the preparation of coloured materials for moſaic work, may, in certain reſpects, be conſidered as branches of the art of colouring glaſs; and in all theſe a beautiful red is the moſt difficult, the deareſt, and the ſcarceſt. When one carefully examines the old maſter-pieces of painting on glaſs, one finds either that the panes have on one ſide a tranſparent red varniſh burnt into them, or that the pieces which are ſtained through and through, are thinner than thoſe coloured in the other manner †. It is, therefore, extremely probable that the old artiſts, as they did not know how to give to thick pieces a beautiful tranſparent red colour,

* Nicolai, ut ſupra.

† See Peter le Vieil's *Kunſt auf glas zu maken*, Nuremberg 1779, 4to. ii. p. 25. This ſingular performance muſt, in regard to hiſtory, particularly that of the ancients, be read with precaution. Seldom has the author peruſed the works which he quotes; ſometimes one cannot find in them what he aſſures us he found, and very often he miſrepreſents their words.

employed

employed only iron, or manganeſe, which pigment, as already obſerved, eaſily becomes in a a ſtrong heat blackiſh and muddy *. Enamel painters, however, were for a long time obliged to be contented with it. A red colour in moſaic work is attended with leſs difficulty, becauſe no tranſparency, nay rather opacity, is required. At Rome thoſe pieces are valued moſt which have the beautiful ſhining red colour of the fineſt ſealing-wax. We are told by Ferber that ſuch pieces were, at one time, made only by a man named Mathioli, and out of a kind of copper droſs; at preſent there are ſeveral artiſts in that city who prepare theſe materials, but they are not able to give them a perfect high colour †.

SEALING-WAX.

WRITERS on diplomatics mention, beſides metals, five other ſubſtances on which impreſſions were made, or with which letters and public acts were ſealed, viz. *terra ſigillaris*, cement, paſte, common wax, and ſealing-wax ‡. The *terra*

* In what the art of Abraham Helmback, a Nuremberg artiſt, conſiſted, I do not know. Doppelmeyer, in his Account of the mathematicians and artiſts of Nuremberg, printed in 1730, ſays that he fortunately revived, in 1717, according to experiments made in a glaſs-houſe, the old red glaſs; the proper method of preparing which had been long loſt.

† Ferber's Briefe aus Welſchland. Prague 1773. 8vo. p. 114.

‡ Gattereri Elementa artis diplomaticæ. Gœttingæ 1765. 4to. p. 285.

ſigillaris

ſigillaris was uſed by the Egyptians, and appears to have been the firſt ſubſtance employed for ſealing *. The Egyptian prieſts bound to the horns of the cattle fit for ſacrifice a piece of paper; ſtuck upon it ſome ſealing earth, on which they made an impreſſion with their ſeal; and ſuch cattle only could be offered up as victims †.

Lucian ſpeaks of a fortune-teller who ordered thoſe who came to conſult him to write down on a bit of paper the queſtions they wiſhed to aſk, to fold it up, and to ſeal it with clay, or any other ſubſtance of the like kind ‡. Such earth ſeems to have been employed in ſealing by the Byzantine emperors; for we are told, that at the ſecond council of Nice, a certain perſon defended the worſhip of images by ſaying, no one believed that thoſe who received written orders from the emperor, and venerated the ſeal, worſhipped on that account the ſealing-earth, the paper, or the lead §.

Cicero

* It is ſingular that Pliny denies that the Egyptians uſed ſeals: Non ſignat Oriens aut Ægyptus etiam nunc, litteris contenta ſolis. Lib. xxxiii. c. 1. Herodotus however, and others, prove the contrary; and Moſes ſpeaks of the ſeal-rings of the Egyptians. See *Goguet*.

† Σημαίνεται βύβλῳ περι τα κέρεα ἐλίσσων. Και ἔπειτα γῆν σημαντρίδα ἐπιπλασας, ἐπιβαλλει τον δακτύλιον. Herodot. lib. ii. c. 38. edit. Francofurti 1608.

‡ Ες βιβλίον ἐγγράψαντα, καταξήρᾶναι τέ, και κατασημήνασθαι κηρῷ ἢ πηλῷ ἤ ἄλλῳ τοιέτῳ. Lucian. in Pſeudomant.

§ Ὁ κέλευσιν βασιλέως δεξάμενος, και ἀσπασάμενος τὴν σφραγίδα, ἢ

Cicero relates, that Verres having ſeen in the hands of one of his ſervants, a letter written to him from Agrigentum, and having obſerved on it an impreſſion in ſealing-earth (*cretula*), he was ſo pleaſed with it that he cauſed the ſeal-ring with which it was made to be taken from the poſſeſſor *. The

τὸν πηλον ἐτίμησεν, ἢ τὴν χάρτην, ἢ τὸν μολυβδον, ἀλλὰ—Act. iv. ap. Bin. tom. ii. Concil. part i. p. 356. Whether the γῆ σημαντις, however, of Herodotus and the πηλος of Lucian and of the Byzantine be the ſame kind of earth, can be determined with as little certainty as whether the *creta*, called by ſome Roman authors a ſealing-earth, be different from both.

* Cum Valentino ejus interpreti epiſtola Agrigento allata eſſet, caſu ſignum iſte animadvertit in cretula; placuit ei; exquiſivit unde eſſet epiſtola; reſpondit, Agrigento: iſte literas ad quos ſolebat, miſit, ut is annulus ad ſe primo quoque tempore afferretur. Ita litteris iſtius patrifamilias, L. Titio cuidam, civi Romano, annulus de digito detractus eſt. *Orat. in Verrem*, iv. c. 9.

In the above paſſage ſome inſtead of *cretula* read *cerula*. I ſhall here take occaſion to remark, alſo, that in the Acts of the Council of Nice before mentioned, inſtead of πηλον ſome read κηρον; but I do not ſee a ſufficient reaſon for this alteration, as in the before quoted paſſage of Lucian it is expreſſly ſaid, that people ſealed κηρῷ ἢ πηλῷ. Reiſke himſelf, who propoſes that amendment, ſays, that πηλὸν may be retained. Stephen, however, does not give that meaning of this word in his Lexicon. Pollux and Heſychius tell us that the Athenians called ſealing-earth alſo ῥύπον. The former, *Onomaſt.* x. 14. 59. ſays, Non ignorandum, quod ceram ſignando idoneam, τον ἐπιτήδειον εἰς τὸ κατασημαίνεσθαι κηρὸν, veteres ῥύπον nominaverunt et ῥύπους, ut in Lyſiſtrate Ariſtophanes: et nihil ita bene concluſum eſſe, quin obſignationes, ῥύπους, avellatis: and the latter, Ῥύπον Αττικοὶ τον εἰς τας σφραγῖδας κηρὸν λεγουσιν: Attici ῥύπον vocant ceram cujus ad ſigilla uſus eſt. Stephen ſays, in his Lexicon, that *rhypos*, in this ſenſe, occurs in Cicero's Letters to Atticus, iii. p. 727: In lib. iii. v. l. annotatur, legi et apud Cic. in ep. ad Att. *rhypos* pro ceris ſive formis unde ſigilla fiebant,

The ſame orator, in his defence of Flaccus, produced an atteſtation ſent from Aſia, and proved its authenticity by its being ſealed with Aſiatic ſealing-earth; with which, ſaid he to the auditors, as you daily ſee, all public and private letters in Aſia are ſealed: and he ſhewed, on the other hand, that the teſtimony brought by the accuſer was falſe, becauſe it was ſealed with wax, and for that reaſon could not have come from Aſia*. The ſcholiaſt Servius relates, that a Sibyl received a promiſe from Apollo, that ſhe ſhould live as long as ſhe did not ſee the earth of the iſland Erythræa where ſhe lived; that ſhe therefore quitted the place, and retired to Cumæ, where ſhe became old and decrepid; but that having received a letter ſealed with Erythræan earth (*creta*), when ſhe ſaw the ſeal ſhe inſtantly expired †. No

fiebant, fortaſſe a ſitu vetuſtatis. But though Cœlius Rhodiginus mentions the ſame thing, *Lection. Antiq.* xxi. 23. in the following words, Pro caeris quoque in epiſtolis ad Atticum legimus *rhypos*, de vetuſtatis ratione nomenclatura accerſita; that expreſſion is not to be found, at preſent, in Cicero.

* Hæc quæ a nobis prolata laudatio, obſignata erat creta illa Aſiatica, quæ fere eſt omnibus nota nobis, qua utuntur omnes non modo in publicis, ſed etiam in privatis litteris, quas quotidie videmus mitti a publicanis, ſæpe unicuique noſtrum. Neque enim teſtis ipſe, ſigno inſpecto, falſum nos proferre dixit; ſed levitatem totius Aſiæ protulit, de qua nos et libenter et facile concedimus. Noſtra igitur laudatio - - - conſignata creta eſt; in illo autem teſtimonio, quod accuſatori dicitur datum, ceram eſſe videmus.—*Orat. pro Flacco*, c. 16.

† Sibyllam Apollo pio more dilexit, et ei obtulit poſcendi quod vellet arbitrium. Illa hauſit arenam manibus, et tam longam vitam

popoſcit.

No one, however, will ſuppoſe that this earth was the ſame as that to which we at preſent give the name of *creta*, chalk; for if it was a natural earth it muſt have been of that kind called potters-clay, as that clay is capable of receiving an impreſſion and of retaining it after it is hardened by drying. That the Romans, under the indefinite name of *creta*, often underſtood a kind of potters-earth, can be proved by many paſſages of their writers. Columella ſpeaks of a kind of chalk of which wine-jars and diſhes were made*. Virgil calls it tough†; and the ancient writers on agriculture give the ſame name to marl which was employed to manure land‡. Notwithſtanding all theſe authorities, it does not appear clear to me

popoſcit. Cui Apollo reſpondit, id fieri poſſe, ſi Erythræam, in qua habitabat, inſulam relinqueret, et eam nunquam videret. Profecta igitur, Cumas tenuit; et illic defecta corporis viribus vitam in ſola voce retinuit. Quod cum cives ejus cognoviſſent, ſive invidia ſive commiſeratione commoti, ei epiſtolam miſerunt creta antiquo more ſignatam; qua viſa, quia erat de ejus inſula, in mortem ſoluta eſt. *Serv. ad lib.* vi. *Æneid.* p. 1037.

* Ex ea creta qua fiunt amphoræ, lata vaſa in modum patinarum fieri jubebat. Lib. xii. c. 43.

† Et creta ſolidanda tenaci. *Georg.* i. v. 179.

‡ Creta foſſica, qua ſtercorantur agri. *Varro*, i. 7. 8.—It appears alſo, that the πηλος of the Greeks ſignified a kind of potters-earth. Thoſe who do not chooſe to rely on our dictionaries, need only to read the ancient Greek writers on huſbandry, who ſpeak of ἀρξάμενοι πηλῷ ἀργιλλώδει. See *Geopon.* x. c. 75. 12. and ix. c. 10. 4. That many kinds of ſealing-earth, without being burnt, will long retain an impreſſion, is proved by the ſealed-earths preſerved in our apothecaries' ſhops, and collections of natural hiſtory.

how

how letters could be ſealed with potters-clay, as it does not adhere with ſufficient force either to linen, of which, in ancient times, the covers of letters were made, or to parchment; as it muſt be laid on very thick to have a diſtinct impreſſion; as it is long in drying, and is again eaſily diſſolved by moiſture; and, at any rate, if conveyed by poſt at preſent, it would be crumbled to duſt in going only from Hamburgh to Altona. I can readily believe that the Roman meſſengers employed more ſkill and attention to preſerve the letters committed to their care than are employed by our poſts; but the diſtance from Aſia to Rome is much greater than that from Hamburgh to Altona.

But may there not be as little foundation for the ancient expreſſion *creta Aſiatica*, Aſiatic earth, as for the modern expreſſion, *cera Hiſpanica*, Spaniſh wax? May not the former have ſignified a kind of coarſe artificial cement? Theſe queſtions might be anſwered by thoſe who have had an opportunity of examining, or only ſeeing, the *ſigilla e creta* in collections of antiquities. We are aſſured that ſuch are ſtill preſerved; at leaſt we find in Ficoroni* the repreſentation of ſix impreſſions which, as he tells us, conſiſted of that earth. In that author, however, I find nothing to clear up my doubts;

* I piombi antichi, opera di Franceſco de Ficoroni. In Roma 1740. 4to. p. 16. Sigilli de creta, tanto più curioſi, quanto più rari.

he ſays only that ſome of theſe ſeals were white; others of a grey colour, like aſhes; others red, and others brown. They ſeem all to have been incloſed in leaden caſes. Could it be proved that each letter was wrapped round with a thread, and that the thread, as in the ſeals affixed to diplomas, was drawn through the covering of the ſeal, the difficulty which I think occurs in the uſe of theſe earths, as mentioned by the ancients, would entirely diſappear *. It ſeems to me remarkable that neither Theophraſtus nor Pliny ſays any thing of the Aſiatic *creta*, or ſpeaks at all of ſealing-earth; though they have carefully enumerated all thoſe kinds of earth which are worth notice on account of any uſe.

In Europe, as far as I know, wax has been every where uſed for ſealing ſince the earlieſt ages. Writers on diplomatics, however, are not agreed whether yellow or white wax was firſt employed; but it appears that the former, on account of its low price, muſt have been firſt and principally uſed, at leaſt by private perſons. It is probable, alſo, that the ſeals of diplomas were more durable when they conſiſted of yellow wax; for it is certain that white wax, which loſes a great part of its inflammable ſubſtance, is more brittle, and much

* Heineccius and others think that the *amphoræ vitreæ diligenter gypſatæ*, in Petronius, were ſealed; but it is much more probable that they were only daubed over or cloſed with gypſum, for the ſame reaſon that we pitch our caſks.

leſs

leſs durable. Many ſeals alſo may at preſent be conſidered white which were at firſt yellow; for not only does wax highly bleached reſume, in time, a dirty yellow colour, but yellow wax alſo, in the courſe of years, loſes ſo much of its colour as to become almoſt like white wax. This perhaps may account for the oldeſt ſeals appearing to be of white, and the more modern of yellow wax. Theſe, however, are conjectures which I ſubmit, with deference, to the determination of thoſe verſed in diplomatics.

In the courſe of time, ſealing-wax was coloured red; and a good deal later, at leaſt in Germany, but not before the fourteenth century, it was coloured green, and ſometimes black. I find it remarked that blue wax never appears on diplomas; and I may, indeed, ſay it is impoſſible it ſhould appear; for the art of giving a blue colour to wax has never yet been diſcovered; and in old books, ſuch as that of Wecker, we find no receipt for that purpoſe. Later authors have pretended to give directions how to communicate that colour to wax: but they are altogether falſe; for vegetable dies, when united with wax, become greeniſh, ſo that the wax almoſt reſembles the hip-ſtone; and earthy colours do not combine with it, but, in melting, fall again to the bottom. A ſeal of blue wax, not coloured blue merely on the outer ſurface, would be as great a rarity in the arts as in di-

plomatics, and would afford matter of ſpeculation for our chemiſts; but I can give them no hopes that ſuch a thing can ever be produced. The emperor Charles V in the year 1524 granted to Dr. Stockamar, of Nuremberg, the privilege of uſing blue wax in ſeals: a favour like that conferred, in 1704, on the manufactories in the principality of Halberſtadt and the county of Reinſtein, to make indigo from minerals. It was, certainly, as difficult for the doctor to find blue wax for ſeals, as for the proprietors of theſe manufactories to diſcover indigo in the earth *.

Much later are impreſſions made on paſte or dough, which perhaps could not be employed on the ancient parchment or the linen covers of lette s, though in Pliny's time the paper then in uſe was joined together with flour paſte †. Proper diplomas were never ſealed with wafers; and in the matchleſs diplomatic collection of H. Gatterer there are no wafer ſeals much above two hundred years old. From that collection I have now in my poſſeſſion one of theſe ſeals, around the impreſſion of which is the following inſcription, *Secretum civium in Ulmia*, 1474; but it is only a new copy of a very old impreſſion. Kings, however, before the

* Cerulæ ceræ licet nullus fere uſus ſit, refert tamen Diether ad Beſold. voce *wax*, Carolum V Imp. doctori Stockhamero Norimbergenſi anno 1524 privilegium tali cera utendi dediſſe. *J. M. Heineccii Syntagma de veteribus ſigillis.* Francof. et Lipſ. 1719. fol. p. 55.

† Farina, qua chartæ glutinantur. Plin. lib. xxii. c. 25.

inven-

invention of ſealing-wax, were accuſtomed to ſeal their letters with this paſte *.

Heineccius and others relate that *maltha* alſo was employed for ſeals. This word ſignifies a kind of cement, formed chiefly of inflammable ſubſtances, and uſed to make reſervoirs, pipes, &c. water-tight. Directions how to prepare it may be found in the writers on agriculture, Pliny, Feſtus, and others. The latter tells how to make it of a compoſition of pitch and wax †: but neither in that author nor in any other have I found proofs that letters were ſealed with it, or that ſeals of it were affixed to diplomas; for the words of Pollux, *cera qua tabellæ judicum obliniebantur* ‡, will admit of a different explanation. If *maltha* has been, in reality, uſed for ſeals, that mixture may be conſidered as the firſt or oldeſt ſealing-wax, as what of it is ſtill preſerved has been compoſed of hard ſubſtances.

Some writers § aſſert, upon the authority of Lebeuf ‖, that ſealing-wax was invented about the

* Trotz, Not. in prim. ſcribendi origine, p. 73, 74.

† *Maltha* dicitur a Græcis pix cum cera mixta. *Feſti et Flacci de verb. ſig.* lib. xx. edit. Dacerii, Lut. Par. 1681. 4to. p. 224. Heſichius calls this cement μεμαλγμένον κηρὸν. Pallad. lib. i. c. 17. Plin. lib. xxxvi. c. 24.

‡ Lib. viii. c. 4.

§ Nouveau traité de diplomatique, par deux Religieux Bénédictins. Paris 1759. 4to. iv. p. 33.

‖ Memoires concernant l'hiſtoire d'Auxerre, par Lebeuf. Paris 1743. ii. p. 517.

year 1640, by a Frenchman named Rouſſeau; but that author refers his readers to Papillon *, who refers again to Pomet †, ſo that the laſt appears to be the firſt perſon who broached that opinion. According to his account Francis Rouſſeau, born not far from Auxerres; who travelled a long time in Perſia, Pegu, and other parts of the Eaſt Indies; and who in 1692 reſided in St. Domingo, was the inventor of ſealing-wax. Having, while he lived at Paris as a merchant, during the latter years of the reign of Louis XIII, who died in 1643, loſt all his property by a fire, he bethought himſelf of preparing ſealing-wax from gum lac, as he had ſeen it prepared in India, in order to maintain his wife and five children. A lady, of the name Longueville, made this wax known at court, and cauſed Louis XIII to uſe it; after which it was purchaſed and uſed throughout all Paris. By this article Rouſſeau, before the expiration of a year, gained 50,000 livres. It acquired the name of *cire d'Eſpagne*, Spaniſh wax, becauſe at that time a kind of gum lac, that was only once melted, and coloured a little red, was called Portugal wax, *cire de Portugal* ‡.

That

* Bibliotheque des auteurs de Bourgogne, par l'abbé Papillon. Dijon 1745. 2 vol. fol. ii. p. 217.

† Hiſtoire générale des drogues, par le Sieur Pomet. Paris 1735. 2 vol. 4to. ii. p. 44. i. p. 28.

‡ This Rouſſeau appears alſo in the Hiſtory of cochineal, as he ſent to Pomet a paper on that ſubject, which was contradicted by the well-known

That ſealing-wax was either very little or not at all known in Germany, in the beginning of the ſixteenth century, may be concluded from its not being mentioned either by Porta or Wecker; though in the works of both theſe authors there are various receipts reſpecting common wax, and little-known methods of writing and ſealing*. The former ſays, that to open letters, in ſuch a manner as not to be perceived, the wax ſeal muſt be heated a little, and muſt be then carefully ſeparated from the letter by a horſe's hair; and when the letter has been read and folded up, the ſeal muſt be again dexterouſly faſtened to it. This manœuvre, as the writers on diplomatics remark, has been often made uſe of to forge public acts; and they have, therefore, given directions how to diſcover ſuch frauds †. The above method of opening letters, however, can be applied only to common wax, and not to ſealing-wax: had the latter

known Plumier, in the *Journal des Sçavans* for 1694. He is mentioned alſo by Labat, who ſays he ſaw him at Rochelle; but at that time he muſt have been nearly an hundred years of age.

* Mr. Von Murr, in his learned *Beſchreibung der merkwürdigkeiten in Nürnberg*, Nurnb. 1778, 8vo. p. 702, ſays, that Spaniſh wax was not invented, or at leaſt not known, before the year 1559. This appears alſo from a manuſcript of the ſame year, which contains various receipts in the arts and medicine. There are ſome in it for making the common white ſealing-wax green or red.

† Quod ſi in ſigillo antiquiori prætenſo reperiatur adhuc ſua ceræ pinguedo, magnaque hinc ejuſdem vel aliqualis ſaltem mollities et tractabilitas;

latter been uſed in Wecker's time, he would have mentioned this limitation *.

Whether ſealing-wax was uſed earlier in the Eaſt Indies than in Europe, as the French think, I cannot with certainty determine. Tavernier †, however, ſeems to ſay that the gum lac produced in the kingdom of Aſem is employed there not only for lackering, but alſo for making Spaniſh ſealing-wax. I muſt confeſs alſo that I do not know whether the Turks and other eaſtern nations uſe it, in general. In the collection of natural curioſities belonging to our univerſity, there are two ſticks of ſealing-wax which profeſſor Butner procured from Conſtantinople, under the name of Turkiſh wax. They are angular, bent like a bow, are neither ſtamped nor glazed, and are of a dark but pure red colour. Two other ſticks which came from the

tractabilitas; ſignum eſt ſigillum tale partum eſſe ſuppoſititium ævi ſequioris. Pari quoque ratione, ſi pars ſigilli poſterior, qua diplomati annexum antiquitus ſigillum extitit, ſimile vel pinguedinis vel mollitiei et tractabilitatis ſignum præ ſe ferat, cum facies anterior reliquas habet genuinæ ætatis antiquitatiſque ſuæ notas et characteres; dubium vix remanet, ſigillum ex antiquiori diplomate deſumptum, et a manu recentiori ſigillo alteri annexum fuiſſe. *Chronic. Godvic.* p. 102.

* Wecker gives directions alſo to make an impreſſion with calcined gypſum, and a ſolution of gum or iſinglaſs. Porta knew that this could be done to greater perfection with amalgama of quickſilver; an art employed even at preſent.

† Tavernier, in his Travels, ſays, that in Surat gum lac is melted, and formed into ſticks like ſealing-wax. Compare with this *Dappers Aſia oder Ausführliche beſchreibung*, &c. Nuremberg, 168 fol. P. 237.

Eaſt

Eaſt Indies are ſtraight, glazed, made ſomewhat thin at both ends, have no ſtamp, and are of a darker and dirtier red colour. All theſe four ſticks ſeem to be lighter than ours, and I perceive that by rubbing they do not acquire ſo ſoon, nor ſo ſtrong an electrical quality as our German wax of moderate fineneſs. But whether the firſt were made in Turkey and the latter in the Eaſt Indies; or whether the whole four were made in Europe, is not known. That ſealing-wax, however, was made and uſed in Germany an hundred years before Rouſſeau's time, and that the merit of that Frenchman conſiſted, probably, only in this, that he firſt made it in France, or made the firſt good wax, will appear in the courſe of what follows.

The oldeſt known ſeal of our common ſealing-wax is that found by Mr. Roos, on a letter written from London, Aug. 3d, 1554, to the rheingrave Philip Francis von Daun, by his agent in England, Gerrard Herman *. The colour of the wax is a dark red; it is very ſhining, and the impreſſion bears the initials of the writer's name G. H. The next ſeal, in the order of time, is one of the year 1561, on a letter written to the

* Bruchſtücke betreffend die beobachtung der pflichten eines ſtaatsdieners; aus den handlungen des Raths Dreiſs, nebſt bemerkungen vom älteſten gebrauche des Spaniſchen ſiegelwachſes—Frankfort on the Mayne 1785. 4to. p. 86; where the uſe of theſe antiquarian reſearches is illuſtrated by examples worthy of notice.

council

council of Gorlitz at Breſlau. This letter was found in the Gorlitz archives by Dr. Anton, and is three times ſealed with beautiful red wax *. In the archives of the before-mentioned family Mr. Roos found two other letters of the year 1566, both addreſſed to the rheingrave Frederick von Daun, from Orchamp in Picardy, by his ſteward Charles de Pouſol; the one dated September the 2d, and the other September the 7th. Another letter, written by the ſame perſon to the ſame rheingrave, but dated Paris January 22d, 1567, is likewiſe ſealed with red wax, which is of a higher colour, and appears to be of a coarſer quality. As the oldeſt ſeals of this kind came from France and England, Mr. Roos conjectures that the invention, as the name ſeems to indicate, belongs to the Spaniards. This conjecture appears to me, however, improbable, eſpecially as ſealing-wax was uſed at Breſlau ſo early as 1561; but this matter can be beſt determined, perhaps, by the Spaniſh literati. It is much to be lamented that John Fen, in his Original letters of the laſt half of the fifteenth century †, when he gives an account of the ſize and ſhape of the ſeals, does not inform us of what ſubſtances they are compoſed. Reſpecting a letter of the year 1455 he ſays, only,

* Hiſtoriſche unterſuchungen geſamlet von J. G. Meuſel. i. 3. p. 240.

† Original letters written during the reign of Henry VI. London 1787. 2 vol. 4to. i. p. xxi. and p. 87 and 92.

"The

"The ſeal is of red wax;" by which is to be underſtood, undoubtedly, common wax.

In the archives of the landgraviate of Caſſel, Mr. Ledderhoſe found two letters of count Louis of Naſſau to the landgrave William IV, one of which, dated March the 3d, 1563, is ſealed with red wax, and the other, dated November 7th, the ſame year, is ſealed with black wax*. Mr. Neuberger, private keeper of the archives at Weymar, found among the records of that duchy a letter ſealed with red wax, and written at Paris, May the 15th, 1571, by a French nobleman named Vulcob, who the year before had been ambaſſador from the king of France to the court of Weymar. It is worthy of remark, that the ſame perſon had ſealed nine letters of a prior date with common wax, and that the tenth is ſealed with Spaniſh wax†. Mr. P. L. Spieſs, principal keeper of the records at Pleſſenburg, who gave riſe to this reſearch by his queries, ſaw a letter of the year 1574 ſealed with red ſealing-wax, and another of the year 1620 ſealed with black ſealing-wax. He found alſo in an old expence book, of 1616, that Spaniſh wax, expreſsly, and other materials for writing were ordered from a manufacturer of ſealing-wax at Nuremberg, for the perſonal uſe of Chriſtian margrave of Brandenburg‡.

* Der Geſchichtforſcher, publiſhed by Meuſel. Halle. 8vo. vi. p. 270.

† Geſchichtforſcher, iv. p. 251. ‡ Ibid.

The oldeſt mention of ſealing-wax which I have hitherto obſerved in printed books, is in the well-known work of Garcia ab Orto *, where the author remarks, ſpeaking of gum lac, that thoſe ſticks uſed for ſealing with were made of it. This book was firſt printed in 1563, about which time it appears that the uſe of ſealing-wax was very common among the Portugueſe.

The oldeſt printed receipt for making ſealing-wax was found by Mr. von Murr, in a work by Samuel Zimmerman, citizen of Augsburg, printed in 1579 †. The copy which I have from the library of our univerſity is ſigned at the end by the author himſelf. His receipts for making red and green ſealing-wax I ſhall here tranſcribe.

" To make hard ſealing-wax, called Spaniſh " wax, with which if letters be ſealed they cannot " be opened without breaking the ſeal: Take " beautiful clear reſin, the whiteſt you can procure, " and melt it over a ſlow coal fire. When it is " properly melted, take it from the fire, and for " every pound of reſin add two ounces of cinnabar " pounded very fine, ſtirring it about. Then let

* Halleri Bibliotheca botan. i. p. 332. *Aromatum et ſimplicium aliquot hiſtoria, Garcia ab Horto auctore.* Antverpiæ 1574. 8vo. p. 33. Ex ea bacilli illi, quibus in obſignandis epiſtolis utimur, conficiuntur:

† The whole title is: New Titularbuch,—ſambt etlichen hinzugethanen gehaimnuſſen und kunſten, das leſen und die ſchreiberey betreffendt. Durch Samuelen Zimmerman, burger zu Augſpurg. 4to. 1579. p. 112.

" the

" the whole cool, or pour it into cold water.
" Thus you will have beautiful red ſealing-wax.

" If you are deſirous of having black wax, add
" lamp-black to it. With ſmalt or azure you may
" make it blue; with white lead white, and with
" orpiment yellow.

" If inſtead of reſin you melt purified turpen-
" tine, in a glaſs veſſel, and give it any colour
" you chooſe, you will have a harder kind of ſeal-
" ing-wax, and not ſo brittle as the former."

What appears to me worthy of remark in theſe receipts for ſealing-wax is, that there is no mention in them of gum lac, which, at preſent, is the principal ingredient, at leaſt in that of the beſt quality; and that Zimmerman's ſealing-wax approaches very near to that which, in diplomatics, is called *maltha*. One may almoſt conclude, therefore, that this invention was not brought from the Eaſt Indies.

The expreſſion Spaniſh wax is of little more import than the words Spaniſh-green, Spaniſh-flies, Spaniſh-graſs, Spaniſh-reed, and ſeveral others, as it was formerly cuſtomary to give to all new things, particularly thoſe which excited wonder, the appellation of Spaniſh; and, in the like manner, many foreign or new articles have been called Turkiſh; ſuch as Turkiſh wheat, Turkiſh paper, &c.

Reſpecting the antiquity of wafers, Mr. Spieſs

has made an obſervation *, which may lead to farther reſearches, that the oldeſt ſeal with a red wafer, he has ever yet found, is on a letter written by D. Krapf, at Spires, in the year 1624, to the government at Bayreuth. Mr. Spieſs has found alſo, that ſome years afterwards Forſtenhauſſer, the Brandenburg factor at Nuremberg, ſent ſuch wafers to a bailiff at Oſternohe. It appears, however, that wafers were not uſed during the whole of the ſeventeenth century, in the chancery of Brandenburg, but only by private perſons, and by theſe even ſeldom; becauſe, as Spieſs ſays, people were fonder of Spaniſh wax. The firſt wafers with which the chancery of Bayreuth began to make ſeals were, according to an expence account of the year 1705, ſent from Nuremberg. The uſe of wax, however, was ſtill continued; and in the Plaſſenburg archives there is a reſcript of 1722, ſealed with proper wax. The uſe of wax muſt have been continued longer in the duchy of Weymar; for in the *Electa juris publici* there is an order of the year 1716, by which the introduction of wafers in law matters is forbidden, and the uſe of wax commanded. This order, however, was aboliſhed by duke Erneſt Auguſtus in 1742, and wafers again introduced.

* Archiviſche nebenarbeiten und nachrichten, geliefert von Phil. Erneſt Spieſs. Halle 1785. 4to. ii. p. 3.

CORN

CORN-MILLS.

IF under this name we comprehend all thoſe machines, however rude, employed for pounding or grinding grain, theſe are of the higheſt antiquity. We read in the Scriptures, that Abraham cauſed cakes to be baked for his gueſts of the fineſt meal*; and that the manna was ground like corn †. The earlieſt inſtrument uſed for this purpoſe ſeems to have been the mortar; which was retained a long time even after the invention of mills properly ſo called, becauſe theſe, perhaps, at firſt were not attended with much ſuperior advantage ‡. It appears, that, in the courſe of time, the mortar was made ridged and the peſtle notched, at

* Geneſis, ch. xviii. v. 6.

† Numbers, ch. xi. v. 8.

‡ Ὅλμον μεν τριποδην ταμνειν, ὑπερον δε τριπηλυν.

Heſiod. Opera et Dies, 422.

Mortarium quidem tripedale ſeca, piſtillum vero tricubitale.

It appears, therefore, that both the mortar and peſtle were then made of wood, and that the former was three feet in height; but, to ſpeak the truth, it is not here expreſsly ſaid that this mortar was for the purpoſe of pounding corn. The mortar was called ὁλμος, pila; the peſtle ὑπερος, or ὑπερον, piſtillus or piſtillum; to pound, μασσειν pinſere, which word, as well as *pinſor*, was afterwards retained when mills came to be uſed. *Servius ad. Virg. Æn.* i. 179. Majores molarum uſum non habebant. Frumenta torrebant, et ea in pilas miſſa pinſebant, et hoc erat genus molendi. Unde et pinſores dicti ſunt, qui nunc piſtores vocantur. *Plin.* lib. xviii. c. 3.

leaſt at the bottom; by which means the grain was rather grated than pounded. A paſſage of Pliny *, not yet ſufficiently cleared up, makes this conjecture probable. When a handle was added to the top of the peſtle, that it might be more eaſily driven round in a circle, the mortar was converted into a hand-mill. Such a mill was called *mola truſatilis*, *verſatilis*, *manuaria* †, and was very little different from thoſe uſed at preſent by apothecaries, painters, potters, and other artiſts, for grinding coarſe bodies, ſuch as colours, glaſs, chalk, &c. ‡ We have reaſon to ſuppoſe that in every family there was a mill of this kind. Moſes forbade them to be taken in pawn; for that, ſays he, is the ſame thing as to take a man's life to pledge. Michaelis, on this paſſage, obſerves that a man could not then grind, and, conſequently, could not bake bread for the daily uſe of his family §. Grinding was at firſt the employment of the women, and particularly of the female ſlaves, as it is

* Piſtura non omnium facilis; quippe Etruria ſpicam farris toſti piſcente pilo præferrato, fiſtula ferrata et ſtella intus denticulata, ut niſi intenti piſant, concidantur grana, ferrumque frangatur. Major pars Italiæ ruido utitur pilo. *Plin.* xviii. 10. ii. p. 111. This paſſage Geſner has endeavoured to explain, in his Index to the *Scriptores rei ruſtica*, p. 59. to which he gives the too dignified title of *Lexicon ruſticum*.

† Plautus ob quærendum victum ad circumagendas molas, quæ truſatiles appellantur, operam piſtori locaſſet. *Gellius*, iii. c. 3.

‡ Thoſe not acquainted with theſe mills may ſee *Hartwig (Sprengels) Handwerke und Künſte*, xiii. p. 125. plate 4, fig. 12. and *Wallerius, Phyſiſche chemie*, i. p. 62.

§ Deuteronomy, ch. xxiv. v. 6.

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at preſent among uncivilized nations, and muſt therefore have required little ſtrength *; but afterwards the mills were driven by bondſmen, around whoſe necks was placed a circular machine of wood, ſo that theſe poor wretches could not put their hands to their mouths, or eat of the meal †.

In the courſe of time, ſhafts were added to the mill, that it might be driven by cattle, which were, as at preſent, blindfolded ‡. The firſt cattle-mills, *molæ jumentariæ* had, perhaps, only a heavy mortar as the hand-mills §; but it muſt have been ſoon remarked that the labour would be more ſpeedily accompliſhed if, inſtead of the peſtle, a large heavy cylindrical ſtone ſhould be employed. I am of opinion, however, that the firſt cattle-mills had not a ſpout or a trough as ours have at

* When Moſes threatened Pharaoh with the deſtruction of the firſt-born in the land of Egypt, he ſaid, "All the firſt-born ſhall die, from "the firſt-born of Pharaoh that ſitteth on the throne, even unto the "firſt-born of the maid-ſervant that is behind the mill." *Geneſis*, ch. xi. v. 5. See *Homeri Odyſſ.* vii. 103, and xx. 105.

† This machine by Pollux is called παυσικακη.

‡ Apuleii Metamorph. lib. ix.

§ The oldeſt cattle-mills have, in my opinion, reſembled the oil-mills repreſented in plate 25th of *Sonnerats Reiſe nach Oſtindien und China*, i. Zurich 1783. 4to. To the peſtle of a mortar made faſt to a ſtake driven into the earth, is affixed a ſhaft to which two oxen are yoked. The oxen are driven by a man, and another ſtands at the mortar to puſh the ſeed under the peſtle. Sonnerat ſays, that with an Indian hand-mill two men can grind no more than ſixty pounds of meal in a day; while one of our mills, under the direction of one man, can grind more than a thouſand.

preſent; at leaſt the hand-mills which Tournefort * ſaw at Nicaria, and which conſiſted of two ſtones, had neither; but the meal which iſſued from between the ſtones, through an opening made in the upper one, fell upon a board or table, on which the lower ſtone, that was two feet in diameter, reſted.

The upper mill-ſtone was called *meta*, or *turbo*; and the lower one *catillus*. *Meta* ſignified alſo a cone with a blunt apex †; and it has on that account been conjectured that corn was at firſt rubbed into meal by rolling over it a conical ſtone flatted at the end, in the ſame manner as painters, at preſent, make uſe of a grinding-ſtone; and it is believed that the ſame name was afterwards given to the upper mill-ſtone. This conjecture is not improbable, as ſome rude nations ſtill bruiſe their corn by grinding ſtones ‡. I do not, however, remember any paſſage in the ancients that mentions this mode of grinding: and I am of opinion that the peſtle of the hand-mill, for which the upper mill-ſtone was ſubſtituted, may, on account of its figure, have been alſo called *meta*. Niebuhr § found in Arabia, beſides hand-mills, ſome grind-

* Voyage du Levant. Amſterd. 1718. 4to. i. p. 155.

† A haycock was called *meta fœni*. Colum. ii. 19. Plin. xxvii 28.

‡ Voyage de Frezier, p. 62.

§ Niebuhrs Beſchreibung von Arabien. Copenhagen 1772. 4to. p. 31. A figure of both ſtones is repreſented in the firſt plate, fig. H.

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ing-ſtones, which differed from thoſe uſed by us in their conſiſting not of a flat, but of an oblong hollow ſtone, or trough, with a peſtle, which was not conical, but ſhaped like a ſpindle, thick in the middle and pointed at both ends. In this ſtone the corn, after being ſoaked in water, was ground to meal, and then baked into cakes.

Reſpecting the figure and conſtruction of the ancient hand-mills, I expected to find ſome information from engraved ſtones, and other remains of antiquity; but my reſearches would have proved fruitleſs had not profeſſor Diez, to whoſe memory and erudition I am much indebted, pointed out to me the only figure of one remaining. I ſay the only one remaining with the more confidence, as Mr. Heyne tells us alſo that he remembers no other. Anthony Francis Gori* has deſcribed a red jaſper, on which is engraved the naked figure of a man, who in his left hand holds a ſheaf of corn, and in the right a machine that in all probability is a hand-mill. Gori conſiders the figure as a repreſentation of the god Eunoſtus, who, as Suidas ſays †, was the god of mills. The machine, which Eunoſtus ſeems to exhibit, or to be ſurvey-

* Memorie di varia erudizione della Societa colombaria Fiorentina. In Livorno 1752. 4to. vol. ii. p. 207. Oſſervazioni del propoſto A. F. Gori, ſopra un' antica gemma anulare rappreſentante Eunoſto dio de mulini.

† Ευνοστος θεος τις φασιν επιμυλιος. Eunoſtus, deus quidam, ut aiunt, molarum præſes.

ing himſelf, is, as far as one can diſtinguiſh (for the ſtone is ſcarcely half an inch in ſize), ſhaped like a cheſt, narrow at the top, and wide at the bottom. It ſtands upon a table, and in the bottom there is a perpendicular pipe from which the meal, repreſented alſo by the artiſt, appears to be iſſuing. Above, the cheſt or body of the mill has either a top with an opening, or perhaps a baſket ſunk into it, from which the corn falls into the mill. On one ſide, nearly about the middle of it, there ariſes a broken ſhank, which, without much ſtraining the imagination, may be conſidered as a handle, or that part of the mill which ſome called *molile*. Though this figure is ſmall, and though it conveys very little idea of the internal conſtruction, one may, however, conclude from it that the roller, whether it was of wood or of iron, ſmooth or notched, did not ſtand perpendicularly, like thoſe of our coffee-mills, but lay horizontally; which gives us reaſon to conjecture a conſtruction more ingenious than that of the firſt invention. The axis of the handle had, perhaps, within the body of the mill, a crown-wheel, that turned a ſpindle, to the lower end of the perpendicular axis of which the roller was fixed. Should this be admitted, it muſt be allowed alſo, that the hand-mills of the ancients had not ſo much a reſemblance to the before-mentioned colour-mills as to the philoſophical mills of our chemiſts; and Langelott,

gelott, conſequently, will not be the real inventor of the latter *. On the other ſide, oppoſite to that where the handle is, there ariſe from the mill of Eunoſtus two ſhafts, which Gori conſiders as thoſe of a beſom and a ſhovel, two inſtruments uſed in grinding; but as the interior part cannot be ſeen, it appears to me doubtful whether theſe may not be parts of the mill itſelf.

The remains of a pair of old Roman mill-ſtones were found in the beginning of this century at Adel in Yorkſhire, a deſcription of which was given by Thornſby †, in the Philoſophical Tranſactions. One of the ſtones was twenty inches in breadth; thicker in the middle than at the edges, and conſequently convex on one ſide. The other was of the ſame form, but had that thickneſs at the edges which the other had in the middle, and ſome traces of notching could be obſerved upon it.

I ſhall not here collect all thoſe paſſages of the ancients which ſpeak of hand- and cattle-mills, becauſe they have been already collected by others, and afford very little information ‡. Neither ſhall I en-

* See Wallerius Phyſiſche chemie, i. p. 62. fig. 73.

† Philoſoph. Tranſact. n. 282, p. 1285, and Philoſ. Tranſ. from the year 1700 to the year 1720, abridged by Henry Jones, London 173 . ii. p. 38.

‡ Joh. Heringii Tractatus de molendinis eorumque jure. Francofurti 1663. 4to. *A very confuſed book, which requires a very patient reader.* F. L. Gœtzius de piſtrinis veterum. Cygneæ 1730. 8vo. *Extracted*

I enquire to what Ceres the Grecians aſcribed the invention of mills *; who Milantes was to whom that honour has been given by Stephanus †; or how thoſe mills were conſtructed which were firſt built by Myletes the ſon of Lelex, king of Laconia ‡. Such reſearches would be attended with little advantage. I ſhall proceed, therefore, to the invention of water-mills.

Theſe appear to have been introduced in the time of Mithridates, Julius Cæſar, and Cicero. Becauſe Strabo § relates that there was a water-mill near the reſidence of Mithridates, ſome have aſcribed the honour of the invention to him; but

tracted chiefly from the former, equally confuſed, and filled with quotations from authors who afford very little inſight into the hiſtory or knowledge of mills. Traité de la police, par De la Mare. G. H. Ayrer de molarum initiis. Proluſio de molarum progreſſibus; *by the ſame.* Gottingen 1772. C. L. Hoheiſelii Diſſ. de molis manualibus veterum. Gedani 1728. Pancirollus, edit. Salmuth. ii. p. 294. Hiſtoire de la vie privée des François, par Le Grand d'Auſſy. Paris 1782. i. p. 33. See Fabricii Bibliographia antiq. Hamburgi 1760, p. 1002.

* Ceres frumenta inſtituit, eadem molere et conficere in Attica; et alia in Sicilia ob id dea judicata. *Plin.* lib. vii. c. 56.

† Stephan. de urbibus, v. μυλαντια.

‡ Μύλητα τὸν Λέλεγος πρῶτον ἀνθρώπων μυλην τε ἑυρειν λεγοντες καὶ εν ταῖς Αλεσιαις ταύταις αλέσαι. Pauſan. Lacon. iii. c. 20. edit. Kuhnii. p. 260.

§ Strabo, lib. xii. edit. Almelov. p. 834. In the Greek ſtands the word ὑδραλέτης, perhaps an ἅπαξ λεγόμενον, which the ſcholiaſts only have explained by a water-mill. In many tranſlations of Strabo that word is wanting. As for example, in the Latin edition of Amſterdam, by John Janſon the younger, 1652, 2 vol. 12mo. ii. p. 196.

we

we can conclude nothing more with certainty from this circumſtance, than that water-mills were at that period known, at leaſt in Aſia. We are told by Pomponius Sabinus, in his remarks upon a poem of Virgil called *Moretus*, that the firſt mill ſeen at Rome was erected on the Tiber, a little before the time of Auguſtus; but of this he produces no proof. As he has taken the greater part of his remarks from the illuſtrations of Servius, and muſt have had a much completer copy of that author than any that has been printed, he may have derived this information from the ſame ſource *. The moſt certain proof that Rome had water-mills in the time of Auguſtus is the deſcription which has been given of them by Vitruvius †, and

* This Pomponius Sabinus, author of a Commentary on the works of Virgil, is called alſo Julius Pomponius Lætus, though in a letter he denies that he is the author. He died in 1496. A good account of him may be found in *Fabricii Biblioth. mediæ et infimæ Latinitatis*, iv. p. 594, and in *Giornale de' letterati d'Italia*, vol. xxii. p. 336. Of his Commentary I have two editions before me, from the library of our univerſity. *Julii Pomponii Sabini in omnia quæ quidem extant Vergilii Mar. Opera commentarii, nunc primum in lucem editi.* Baſiliæ 1544. 8vo. *Vergilii Opera cum variorum commentariis, ſtudio L. Lucii.* Baſiliæ 1613. fol. Where the poet gives an ingenious deſcription of a hand-mill, Pomponius adds: Uſus molarum ad manum in Cappadocia inventus; inde inventus uſus earum ad ventum et ad equos. Paulo ante Auguſtum molæ aquis actæ Romæ in Tiberi primum factæ, tempore Græcorum, cum fornices diruiſſent.

† Fiunt etiam in fluminibus rotæ eiſdem rationibus, quibus ſupra ſcriptum eſt. Circa earum frontes affiguntur pinnæ, quæ cum percutiuntur ab impetu fluminis, cogunt progredientes verſari rotam; et ita

and the pretty epigram of Antipater: "Ceaſe "your work, ye maids, ye who laboured in the "mill; ſleep now, and let the birds ſing to the "ruddy morning; for Ceres has commanded the "water nymphs to perform your taſk: theſe, "obedient to her call, throw themſelves on the "wheel, force round the axle-tree, and by theſe "means the heavy mill." This Antipater *, as Salmaſius with great probability aſſerts, lived in the time of Cicero. Palladius † alſo ſpeaks with

ita modiolis aquam haurientes et in ſummum referentes, ſine operarum calcatura, ipſius fluminis impulſu verſatæ, præſtant quod opus eſt, ad uſum. Eadem ratione etiam verſantur hydraulæ, in quibus eadem ſunt omnia, præterquam quod in uno capite axis habent tympanum dentatum et incluſum; id autem ad perpendiculum collocatum in cultrum, verſatur cum rota pariter. Secundum id tympanum, majus item dentatum planum eſt collocatum, quo continetur axis, habens in ſummo capite ſubſcudem ferream, qua mola continetur. Ita dentes ejus tympani, quod eſt in axe incluſum, impellendo dentes tympani plani, cogunt fieri molarum circinationem, in qua machina impendens infundibulum ſubminiſtrat molis frumentum, et eadem verſatione ſubigitur farina. Lib. x. c. 10.

We learn from this paſſage, that the ancients had wheels for raiſing water, which were driven by being trod upon by men. That condemnation to theſe machines was a puniſhment, appears from *Artemidorus*, lib. i. c. 50, and *Sueton. Vita Tiber.* cap. 51. Uno ex his equeſtris ordinis viro et in antliam condemnato.

* This Greek epigram was firſt made known by Saumaiſe, in his Annotations on the Life of Heliogabalus by Lampridius. See *Hiſtoriæ Auguſtæ ſcriptores recenſiti, a C. Salmatio.* Pariſiis 1620. fol. p. 193. It is to be found alſo in *Mémoires de l'Académie des inſcriptions*, ii. p. 315, and in *Analecta veterum Græcorum*, edit. Brunk. ii. p. 119. epig. 39.

† Si aquæ copia eſt, fuſuras balnearum debent piſtrina ſuſcipere; ut ibi

with equal clearneſs of water-mills, which he adviſes to be built on poſſeſſions that have running water, in order to grind corn without men or cattle.

There are alſo other paſſages of the ancients which are commonly ſuppoſed, but without certain grounds, to allude to water-mills. Among theſe is the following verſe of Lucretius *:

Ut fluvios verſare rotas atque hauſtra videmus.

It appears alſo that one cannot conſider as mills the water-wheels to which Heliogabalus cauſed ſome of his friends and paraſites to be bound †. Theſe, as well as the *hauſtra* of Lucretius, were machines for raiſing water, like thoſe mentioned in the before quoted paſſage of Vitruvius ‡. It is, however,

ibi formatis aquariis molis, ſine animalium vel hominum labore, frumenta frangantur. *Pallad. de re ruſtica*, lib. i. 42. edit. Geſn. ii. p. 892.

* Lucret. v. 517. Compare Salmaſ. ad Solin. p. 416.

† Paraſitos ad rotam aquariam ligabat, et cum vertigine ſub aquas mittebat rurſuſque in ſummum revolvebat, eoſque Ixionios amicos vocavit. *Lamprid. in Vita Heliogabali.*

‡ Among the doubtful paſſages is one of Pliny, lib. xviii. c. 10, the beginning of which has been quoted already: Major pars Italiæ ruido utitur pilo; rotis etiam, quas aqua verſet obiter, et molat. So reads Hardouin: but the French tranſlator of Pliny divides theſe words otherwiſe, and reads thus: Major pars Italiæ ruido utitur pilo, rotis etiam quas aqua verſet; obiter et molit; which he tranſlates as follows: *Dans le majeure partie de l'Italie, on ſe ſert d'un pilon rabotteux, ou de roues que l'eau fait tourner; et par fois auſſi on y emploie la meule.* Hiſtoire naturelle de Pline, traduite en François. Paris 1771 and following

however, evident that there were water-mills at Rome at this period; and it affords matter of ſurpriſe that we do not find mention oftener made of them, and that they did not entirely baniſh the uſe of the laborious hand and cattle mills. That this was not the caſe, and that the latter were very numerous for ſome time after, may be concluded from various circumſtances. When Caligula, about twenty-three years after the death of Auguſtus, took away all the horſes and cattle from the mills, in order to tranſport effects of every kind which he had ſeized, there aroſe a ſcarcity of bread at Rome; from which Beroaldus juſtly infers that water-mills muſt have been then very rare *. Nay, more than three hundred years after Auguſtus, cattle-mills were ſo common at Rome, that their number amounted to three hundred †. Mention of them, and of the hand-

lowing years, 11 vol. 4to. vi. p. 349, and b. vii. ch. 56, note 6. This explanation is, in my opinion, very proper. Pliny is not ſpeaking here of the labour of grinding corn, but that of freeing it from the huſks, or of converting it into groats. For this purpoſe a mortar was uſed, the peſtle of which could be ſo managed that the grain remained whole; but water-wheels were ſometimes employed alſo. I agree with Le Prince (*Journal des Sçavans* 1779, Septem.) who thinks that Pliny here certainly ſpeaks of a water-mill.

* In Gallia quoque cum damnatarum ſororum ornamenta, et ſupellectilem, et ſervos, atque etiam liberos, immenſis prætiis vendidiſſet: invitatus lucro, quidquid inſtrumenti veteris aulæ erat, ab urbe repetiit: comprehenſis ad deportandum meritoriis quoque vehiculis, et piſtrinenſibus jumentis: adeo ut et panis Romæ ſepe deficeret. *Sueton. Vita Calig.* cap. 39.

† Petr. Victor. de regionibus urbis Romæ.

mills,

mills, occurs, therefore, always for a long time after in the laws. The Juriſt Paulus, who lived about the year 240, particularizing the bequeſt of a baker, mentions *aſina molendaria* and *mola*, a mill-aſs and a mill *. In the year 319 Conſtantine ordered that all the ſlaves condemned to the mills ſhould be brought from Sardinia to Rome †. Such orders reſpecting mill ſlaves occur alſo under Valentinian ‡. When by the introduction of chriſtianity, however, the morals of men became improved, ſlaves were leſs frequent; and Auſonius, who lived under Theodoſius the Great, about the end of the third century, expreſſly ſays, that in his time the practice had ceaſed of condemning criminals to ſlavery, and of cauſing mills to be driven by men.

Public water-mills, however, appear for the firſt time under Honorius and Arcadius; and the oldeſt laws which mention them, about the year 398, ſhew clearly that they were then a new eſtabliſhment, which it was neceſſary to ſecure by the ſupport of government; and the orders for

* Digeſtorum Lib. xxxiii. tit. 7, 18, Cum de lanionis.

† Cod. Theodoſ. lib. ix. tit. 40, 3, or l. 3, Quicunque. C. Th. de pœnis.

‡ Cod. Theodoſ. lib. xiv. tit. 3, 7, or l. 7, Poſt quinquennii. C. Th. de piſtoribus. At preſent there are no other mills in Sardinia than ſuch as are driven by aſſes. See *Franceſco Cetti, Quadrupedi di Sardegna*. Seſſari 1778. 8vo.

that

that purpoſe were renewed and made more ſevere by Zeno towards the end of the fifth century *. It is worthy of remark, that in the whole code of Juſtinian one does not find the leaſt mention of wooden pales or poſts, which occur in all the new laws; and which, when there were ſeveral mills ſituated in a line on the ſame ſtream, occaſioned ſo many diſputes †. The mills at Rome were erected on thoſe canals which conveyed water to the city; and becauſe theſe were employed in ſeveral arts, and for various purpoſes, it was ordered that by dividing the water the mills ſhould be always kept going. The greater part of them lay under Mount Janiculum ‡; and, as they were driven by ſo ſmall a quantity of water, they probably exe-

* Cod. Theodoſ. lib. xiv. tit. 15, 4; and Cod. Juſtin. lib. xi. tit. 42, 10. Many things relating to the ſame ſubject may be found in Caſſiodorus—Dicitur, commodi cura privati, aquam formarum, quam ſummo deceret ſtudio communiri, ad aquæ molas exercendas vel hortos irrigandos fuiſſe, derivatam. Turpe hoc et miſerabile in illa urbe fieri, quod per agros vix deceret aſſumi. *Caſſiodori Opera.* Genevæ 1650. 4to. p. 104.

† See J. M. Biler, Diſſ. de arbore et palo molinario. Halæ 1730. 4to.

‡ Procopius, Gothicorum lib. i. c. 9.

Quæ regio gradibus vacuis jejunia dira
Suſtinet? aut quæ Janiculi mola mota quieſcit?
Prudentius contra Symmachum, lib. ii. v. 948.

The Gloſſary remarks on this paſſage: Janiculus mons eſt ubi templum Jani erat, et multæ molæ conſtructæ. Compare *R. Fabretti Diſſ. tres de aquis et aquæductibus veteris Romæ*, n. 347, p. 176. See alſo *Grævii Theſaur. Antiq. Rom.* iv. p. 1677.

cuted very little work; and for this reaſon, but chiefly on account of the great number of ſlaves, and the cheap rate at which they were maintained, theſe noble machines were not ſo much uſed, nor were ſo ſoon brought to perfection as they might have been. It appears, however, that after the abolition of ſlavery they were much improved and more employed; and to this a particular incident ſeems, in ſome meaſure, to have contributed.

When Vitiges, king of the Goths, beſieged Beliſarius in Rome, in the year 536, and cauſed the fourteen large expenſive aqueducts to be ſtopped, the city was ſubjected to great diſtreſs; not on account of the want of water in general, becauſe it was ſecured againſt that inconvenience by the Tiber; but on account of the loſs of that water which the baths required, and, above all, of that neceſſary to drive the mills, which were all ſituated on theſe canals. Horſes and cattle, which might have been employed in grinding, were not to be found: but Beliſarius fell upon the ingenious contrivance of placing boats upon the Tiber, on which he erected mills that were driven by the current. This experiment was attended with complete ſucceſs; and as many mills of this kind as were neceſſary were conſtructed. To deſtroy theſe, the beſiegers threw into the ſtream logs of wood, and dead bodies, which floated down the

river into the city; but the beſieged, by making uſe of booms, to ſtop them, were enabled to drag them out before they could do any miſchief*. This ſeems to be the invention of floating-mills, at leaſt I know of no other. It is certain that, by theſe means, the uſe of water-mills became very much extended; for floating mills can be conſtructed almoſt upon any ſtream, without forming an artificial fall; they can be ſtationed at the moſt convenient places, and they riſe and fall of themſelves with the water. They are, however, attended with theſe inconveniences, that they require to be ſtrongly ſecured; that they often

* The account of Procopius, in the firſt book of the War of the Goths, deſerves to be here given at length. "When theſe aqueducts were cut off by the enemy, as the mills were ſtopped for want of water, and as cattle could not be found to drive them, the Romans, cloſely beſieged, were deprived of every kind of food (for with the utmoſt care they could ſcarcely find proviſions for their horſes). Beliſarius, however, being a man of great ingenuity, deviſed a remedy for this diſtreſs. Below the bridge, which reaches to the walls of Janiculum, he extended ropes well faſtened, and ſtretched acroſs the river from both banks. To theſe he affixed two boats of equal ſize, at the diſtance of two feet from each other, where the current flowed with the greateſt velocity, under the arch of the bridge, and placing large mill-ſtones in one of the boats, ſuſpended in the middle ſpace a machine by which they were turned. He conſtructed, at certain intervals, on the river, other machines of the like kind, which being put in motion by the force of the water that ran below them, drove as many mills as were neceſſary to grind proviſions for the city, &c. See the Latin tranſlation of Procopius, Baſil 1531. fol. p. 44. The ſame account may be found in *Leonardi Aretini lib.* i. *de bello Italico adverſus Gothos*; which has been copied by Joh. Magnus in *Hiſtoria de omnibus Gothorum Sueonumque regibus*. Romæ 1554. fol. p. 376.

block

block up the ſtream too much, and move ſlowly, and that they often ſtop when the water is too high, or when it is frozen.

After this improvement the uſe of water-mills was never laid aſide or forgotten: they were ſoon made known all over Europe; and were it worth the trouble, one might quote paſſages in which they are mentioned in every century. The Salic and other old laws * provided like ſecurity for theſe mills, which they call *molina* or *farinaria*; and define a puniſhment for thoſe who deſtroy the ſluices, or ſteal the mill-irons *(ferramentum)*. But there were water-mills in Germany and France a hundred years before the Salic laws were formed. Au-

* Si quis ingenuus annonam in molino furaverit - - - - Si quis ſcluſam de farinario alieno ruperit - - - - Si quis ferramentum de molino alieno furaverit - - - - *Leges Francorum Salicæ*, edit. Eccardi, Franeof. et Lipſiæ 1720. fol. p. 51. *Scluſa* is tranſlated *ſluice*, and there is no doubt that the Freneh word *eſcluſe* is derived from it. All theſe words come from *ſchlieſſen* to ſhut up, or the Low Saxon *ſchluten*: but by that word, in theſe laws, we can hardly underſtand thoſe expenſive works which we at preſent call ſluices, but probably wiekets and what elſe belonged to the dam. *Lex Wiſigothorum*, lib. viii. tit. 4, 30, may ſerve farther to illuſtrate this ſubject: De confringentibus molina et concluſiones aquarum. Si quis molina violenter effregerit, quod fregit intra triginta dies reparare cogatur.—Eadem et de ſtagnis, quæ ſunt circa molina concluſiones aquarum, præcipimus cuſtodire. The *ſcluſæ* are here called *concluſiones aquarum*, to which belong alſo the mounds or dykes. See *Corpus juris Germanici antiqui*, ed. Georgiſch. Halæ 1738. 4to. p. 2097. Gregory of Tours calls them in a paſſage which here follows *excluſas*. But what is *ferramentum?* The iron work of our mills cannot be ſo eaſily ſtolen as to render it neceſſary to ſecure them by particular laws.

ſonius, who lived about the year 379, mentions ſome which were then ſtill remaining on a ſmall ſtream that falls into the Moſelle, and which were noticed alſo by Fortunatus *, in the fifth century. Gregory of Tours, who wrote towards the end of the ſixth century, ſpeaks of a water-mill which was ſituated near the town of Dijon; and of another which a certain abbot cauſed to be built for the benefit of his convent †. Brito, who in the beginning of the thirteenth century wrote in verſe an account of the actions of Philip Auguſtus king of France ‡, relates how by the piercing of a dam the mills near Gournay (*caſtrum Gornacum* or *Cornacum*) were deſtroyed, to the great detriment of the beſieged. In the firſt cruſade, at the end of

* Præcipiti torquens cerealia ſaxa rotatu.

Auſon. Moſella, v. 362.

Ducitur in rigidis ſinuoſa canalibus unda,
Ex qua fert populo hic mola capta cibum.

Venantii Hon. Clement. Fortunati Carmina, edit. Broweri, Moguntiæ 1617. 4to. p. 83.

† Fluviolus ante portam molendinas mira velocitate divertit. *Gregorii Turonenſis Opera*, ed. Theod. Ruinart. Lutet. Pariſ. 1699. fol. Hiſt. lib. iii. 19. p. 126.——Dum Urſus abbas hæc ageret, ac fratres molam manu vertentes triticum ad victus neceſſarium comminuerent, pro labore fratrum viſum eſt ei molendinum in ipſo Angeris fluvii alveo ſtabilire; defixiſque per flumen palis, aggregatis lapidum magnorum acervis excluſas fecit, atque aquam canale collegit, cujus impetu fabricæ rotam in magna volubilitate vertere fecit; hoc opere laborem monachorum relevans, atque uni fratrum delegans, opus neceſſarium implebatur. *Ibid.* Vita patrum, 18. p. 1242.

‡ Gul. Britonis Philippidos libri xii. editi a C. Barthio. Cygneæ 1657. 4to. lib. vi. v. 220. p. 115.

the

the eleventh century, the Germans burned in Bulgaria ſeven mills, which were ſituated below a bridge on a ſmall rivulet, and which ſeem to have been floating mills *. In deeds of the twelfth and thirteenth century, water-mills are often called *aquimollia*, *aquimoli*, *aquiſmoli*, *aquimolæ* †. Petrus Damiani, one of the fathers of the eleventh century, ſays, *Sicut aquimolum nequaquam poteſt ſine gurgitis inundantia frumenta permolere, ita*, &c. ‡

At Venice and other places, there were mills which righted themſelves by the ebbing and flowing of the tide, and which every ſix hours changed the poſition of the wheels ||. Zanetti ¶ has ſhewn, from ſome old charters, that ſuch mills exiſted about the year 1044; and with ſtill more certainty in 1078, 1079 and 1107. In one charter are the

* Septem molendinis, quæ ſub ponte in flumine degebant, ignem ſubmiſerunt. *Chronicon Hieroſolymitanum*, edit. a Reinero Reineccio. Helmſtadii 1584. 4to. lib. i. c. 10. p. 7.

† See Gloſſarium novum ad ſcriptores medii ævi, collegit Carpentier. Pariſiis 1766. fol. vol. i. p. 266. In a chronicle written in the year 1290, a floating mill is called *molendinum navale*, alſo *navencum*; and in another chronicle of 1301, *molendinum pendens*. See alſo *Gloſſarium manuale*, tom. iv. Halæ 1776. 8vo. p. 721.

‡ Damiani Opera omnia, edit. Cajetani. Pariſiis 1743. fol tom. i. p. 105. lib. vi. epiſt. 23.

|| A new invention of this kind may be ſeen in *The Advancement of Arts, Manufactures and Commerce*, by W. Bailey. Lond. 1772. fol. In Engliſh ſuch a mill is called a *tide-mill*.

¶ Girolano Zanetti dell' origine di alcune arti principali appreſſo i Veneziani libri due. Venezia 1758. 4to. p. 71.

words: *Super toto ipſo aquimolo molendini poſito in palude juxta campo alto*; where the expreſſion *aquimolum molendini* deſerves to be particularly remarked, as it perhaps indicates that the mill in queſtion was a proper grinding-mill. Should this conjecture be well founded, it would prove that ſo early as the eleventh century water-mills were uſed not only for grinding corn, but for many other purpoſes.

It appears that hand-and cattle-mills were every where ſtill retained at private houſes a long time after the erection of water-mills. We read in the Life of St. Benedict, that he had a mill with an aſs, to grind corn for himſelf and his colleagues. Among the legendary tales of St. Bertin, there is one of a woman who, becauſe ſhe ground corn on a faſt-day, loſt the uſe of her arm; and of another whoſe hand ſtuck to the handle, becauſe ſhe undertook the ſame work at an unſeaſonable time. More wonders of this kind are to be found at later periods in the Popiſh mythology. Such ſmall mills remained long in the convents; and it was conſidered as a great merit in many eccleſiaſtics, that they ground their own corn in order to make bread. The real cauſe of this was, that as the convents were entirely independent of every perſon without their walls, they wiſhed to ſupply all their wants themſelves as far as poſſible; and as theſe lazy eccleſiaſtics had, beſides, too little labour and exerciſe, they employed grinding as an amuſement, and to enable them to digeſt better their ill-

ill-deſerved food. Sulpicius Severus * gives an account of the mode of living of an Eaſtern monk, in the beginning of the fifth century, and ſays expreſsly that he ground his own corn. Gregory of Tours mentions an abbot who eaſed his monks of their labour at the hand-mill, by erecting a water-mill †. It deſerves here to be remarked, that, in the ſixth century, malefactors in France were condemned to the mill, as is proved by the hiſtory of Septimina the nurſe of Childebert ‡.

The entruſting that violent element water to ſupport and drive mills conſtructed with great art, diſplayed no little ſhare of boldneſs; but it was ſtill more adventurous to employ the no leſs violent but much more untractable, and always changeable wind for the ſame purpoſe. Though the ſtrength and direction of the wind cannot be any way altered, it has however been found poſſible to deviſe means by which a building can be moved in ſuch a manner that it ſhall be expoſed to neither more nor leſs wind than is neceſſary, let it come from what quarter it may.

It is very improbable, or much rather falſe, that

* Dialog. i. 2. edit. Hornii. Amſtel. 1665. 8vo. p. 449.

† See Gregory of Tours, *ut ſupra.*

‡ Septimina vehementer cæſa, ac cauteriis accenſis in facie vulnerata, ablatis omnibus quæ habebat, in Marilegium villam deducitur, ut ſcilicet, trahens molam, his quæ in gynæcio erant poſitæ, per dies ſingulos farinas ad victus neceſſarias præpararet. *Hiſtor. Francorum*, lib. ix. 38. p. 462.

the Romans had wind-mills, though Pomponius Sabinus affirms ſo, but without any proof *. Vitruvius †, where he ſpeaks of all moving forces, mentions alſo the wind; but he does not ſay a word of wind-mills; nor are they noticed either by Seneca ‡ or Chryſoſtom ||, who have both ſpoken of the advantage of the wind. I conſider as falſe alſo, the account given by an old Bohemian annaliſt ¶, who ſays that before the year 718 there were none but wind-mills in Bohemia, and that water-mills were then introduced for the firſt time. I am of opinion that the author meant to have written *hand- and cattle-mills* inſtead of *wind-mills*.

It has been often aſſerted, that theſe mills were firſt invented in the Eaſt, and introduced into Europe by the cruſaders; but this alſo is improbable. For mills of this kind are not at all or very ſeldom found in the Eaſt. There are none of them in Perſia, Paleſtine, or Arabia, and even water-mills

* See Pomponius Sabinus, *ut ſupra*.

† Lib. ix. c. 9. lib. x. c. 1, 13.

‡ Natur. quæſt. lib. v. c. 18.

|| Chryſoſt. in pſalm. cxxxiv. p. 362.

¶ At the ſame period (718) one named Halck the ſon of Uladi, the weak, built cloſe to the city an ingenious mill which was driven by water. It was viſited by many Bohemians, in whom it excited much wonder, and who taking it as a model built others of the like kind here and there on the rivers; for before that time all the Bohemian mills were wind-mills, erected on mountains. *Wenceſlai Hageeii Chronic. Bohem.* tranſlated into German by John Sandel. Nuremberg 1697. fol. p. 13.

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are there uncommon, and conſtructed on a ſmall ſcale. Beſides, we find wind-mills before the cruſades, or at leaſt at the time when they firſt began. It is probable that theſe buildings may have been made known to a great part of Europe, and particularly in France and England *, by thoſe who returned from theſe expeditions; but it does not thence follow, that they were invented in the Eaſt †. The cruſaders perhaps ſaw ſuch mills in the courſe of their travels through Europe; very probably in Germany, which is the original country of moſt

* See De la Mare, Traité de la police, &c. *ut ſupra*. Deſcription du duché de Bourgogne. Dijon 1775. 8vo. i. p. 163. Dictionnaire des Origines, par d'Origny, v. p. 184. The laſt work has an attracting title, but it is the worſt of its kind, written without correctneſs and without judgment, and without giving authorities.

† There are no wind-mills at Iſpahan, nor in any part of Perſia. The mills are all driven by water, by the hand, or by cattle. *Voyages de Chardin*. A Rouen 1723. 8vo viii. p. 221.—The Arabs have no wind-mills; theſe are uſed in the Eaſt only in places where no ſtreams are to be found; and in moſt parts the people make uſe of hand-mills. Thoſe which I ſaw on Mount Lebanon and Mount Carmel, had a great reſemblance to thoſe which are found in many parts of Italy. They are exceedingly ſimple, and coſt very little. The mill-ſtone and the wheel are faſtened to the ſame axis. The wheel, if it can be ſo called, conſiſts of eight hollow boards, ſhaped like a ſhovel, placed acroſs the axis. When the water falls with violence upon theſe boards it turns them round and puts in motion the mill-ſtone, over which the corn is poured. *Darvieux, Merkwürdige nachrichten von ſeinen reiſen.* Part iii. Copenhagen and Leipſic 1754. 8vo. p. 201.—I did not ſee either water- or wind-mills in all Arabia. I, however, found an oil-preſs at Tehama, which was driven by oxen; and thence ſuppoſe that the Arabs have corn-mills of the like kind. *Niebuhr, Beſchreibung von Arabien*, p. 217.

large

large machines. In the like manner, the knowledge of ſeveral uſeful things has been introduced into Germany by ſoldiers who have returned from different wars; as the Engliſh and French, after their return from the laſt war, made known in their different countries many of our uſeful implements of huſbandry, ſuch as our ſtraw-chopper, ſcythe, &c.

Mabillon mentions a diploma of the year 1105, in which a convent in France is allowed to erect water- and wind-mills, *molendina ad ventum* *. In the year 1143, there was in Northamptonſhire an abbey, ſituated in a wood, which in the courſe of 180 years was entirely deſtroyed. One of the cauſes of this deſtruction was ſaid to be, that in the whole neighbourhood there was no houſe, wind- or water-mill built, for which timber was not taken from this wood †. In the twelfth century, when theſe

* Iiſdem etiam facultatem concceſſit conſtituendi domos, ſtagna, molendina ad aquam et ventum, in epiſcopatu Ebroicenſi, Conſtantienſi et Bajocenſi, ad augendos monaſterii proventus. *Mabillon, Annales Ordinis S. Benedicti.* tom. v. Lut. Pariſ. 1713. fol. p. 474.

† Præterea non fuit in patria, aula, camera, orreum, molendinum venticium ſive aquaticum alicujus valoris plantata ſine adminiculo aliquo boſcorum Sanctæ Mariæ de Pipewalla (ſo the wood was called). Et quot virgæ molendinorum venticiorum dabantur in temporibus diverſorum abbatum, nemo novit niſi Deus. Cauſſa tertia deſtructionis boſcorum fuit in conſtructione et emendatione domorum infra abbathiam et extra, utpote in grangiis, orreis, bercariis, molendinis aquaticis et venticiis per vices.——The letter of donation, which appears alſo to be of the twelfth century, may be found in the ſame collection, vol. ii. p. 459. In it occurs the expreſſion *molendinum ventriticum*.

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theſe mills begin to be more common, a diſpute aroſe whether the tythes of them belonged to the clergy; and pope Celeſtine III determined the queſtion in favour of the church *. In the year 1332, one Bartolomeo Verde propoſed to the Venetians to build a wind-mill. When his plan had been examined, a place was aſſigned to him, which he was to retain in caſe his undertaking ſhould ſucceed within a time ſpecified †. In the year 1393, the city of Spires cauſed a wind-mill to be erected, and ſent to the Netherlands for a perſon acquainted with the method of grinding by it ‡. A wind-mill was alſo conſtructed at Francfort in 1442, but I do not know whether there had not been ſuch there before ||.

To turn the mill to the wind, two methods have been invented. The whole building is conſtructed in ſuch a manner as to turn on a poſt below, or the roof alone, together with the axle-tree, and the

In a charter alſo in vol. iii. p. 107. we read of *molendinum ventorium*. *Monaſticon Anglicanum, ſive Pandectæ Coenobiorum*, edit. ſec. Lond. 1682. fol. i. p. 816.

* De reditibus molendini ad ventum ſolvendæ ſunt decimæ. *Decretal. Greg.* lib. iii. tit. 30. c. 23.

† Gir. Zanetti dell' origine di alcune arte appreſſo i Veneziani. Venez. 1758. 4to. p. 74. Pro faciendo unum molendinum a vento. *Le Bret, Geſchichte von Venedig*, ii. 1. p. 233.

‡ Lehmanns Chronica der Stadt Speyer. Frankf. 1662. 4to. p. 847. "Sent to the Netherlands for a miller who could grind with the wind-"mill."

|| Lerſner, Frankf. Chronik. ii. p. 22.

wings

wings are moveable. Mills of the former kind are called German-mills, thoſe of the latter Dutch. They are both moved round either by a wheel and pinion within, or by a long lever without *. I am inclined to believe, that the German-mills are older than the Dutch; for the oldeſt deſcriptions which I can remember, ſpeak only of the former. Hieronymus Cardan †, in whoſe time wind-mills were very common both in France and Italy, makes however no mention of the latter; and the Dutch themſelves affirm, that the mode of building with a moveable roof was firſt found out by a Fleming in the middle of the ſixteenth century ‡. Thoſe mills, by which in Holland the water is drawn up and thrown off from the land, one of which was built at Alkmaar in 1408, another at Schoonhoven in 1450, and a third at Enkhuiſen in 1452, were at firſt driven by horſes, and afterwards by wind. But

* Deſcriptions and figures of both kinds may be found in Leupold's *Theatrum machinarum generale*. Leipzig 1724. fol. p. 101. tab. 41, 42, 43.

† Nor can I paſs over in ſilence what is ſo wonderful, that before I ſaw it I could neither believe nor relate it, though commonly talked of, without incurring the imputation of credulity. But a thirſt for ſcience overcomes baſhfulneſs. In many parts of Italy, therefore, and here and there in France, there are mills which are turned round by the wind. *De rerum varietate*, lib. i. cap. 10. in the edition of all his works, Lugduni 1663. fol. vol. iii. p. 26.

‡ This account I found in *De koophandel van Amſterdam, door Le Long*. Amſt. 1727. 2 vol. 8vo. ii. p. 584. *De beweegelyke kap, om de moolens op all winden te zetten, is eerſt in't midden van de* xvide. *eeuw door een Vlaaming*

But as theſe mills were immoveable, and could work only when the wind was in one quarter, they were afterwards placed not on the ground, but on a float which could be moved round in ſuch a manner that the mill ſhould catch every wind*. This method gave riſe perhaps to the invention of moveable mills.

It is highly probable, that in the early ages men were ſatisfied with only grinding their corn, and that in the courſe of time they fell upon the invention of ſeparating the meal from the pollard or bran. This was at firſt done by a ſieve moved with the hands; and even yet in France, when what is called *mouture en groſſe* is employed, there is a particular place for bolting, where the ſieve is moved with the hand by means of a handle. It is cuſtomary alſo in many parts of Lower Saxony and Alſace, to bolt the flour ſeparately; for which pur-

Vlaaming uytgevonden. "The moveable top for turning the mill "round to every wind was firſt found out in the middle of the ſix-"teenth century by a Fleming." We read there that this is remarked by John Adrian Leegwater; but of this man I know nothing more than what is related of him in the above work, that he was celebrated on account of various inventions, and died in 1650, in the ſeventy-fifth year of his age. See alſo *Beſchryving der Stadt Delft, door verſcheide Liefhebbers en Kenners der Nederlandſche oudheden.* Te Delft, 1729: fol. p. 623.

* De molens hadden doen (toen) vaſte kappen, zoo datze maar met eene wind malen konde, waarom men op zekere plaats, om dit ongeval voor te kommen, een molen op een groot vlot neder zette, dat men dan naar den wind draide. See the *Hiſtory of the city of Delft*, above quoted.

poſe

poſe various ſieves are neceſſary. The Romans had two principal kinds *cribra excuſſoria* and *pollinaria*, the latter of which gave the fineſt flour, called *pollen*. Sieves of horſe-hair were firſt made by the Gauls, and thoſe of linen by the Spaniards *. The method of applying a ſieve in the form of an extended bag to the works of the mill, that the meal might fall into it as it came from the ſtones, and of cauſing it to be turned and ſhaken by the machinery, was firſt made known in the beginning of the ſixteenth century, as we are expreſsly told in ſeveral ancient chronicles †.

This invention gave riſe to an employment which at preſent maintains a great many people; I

* Cribrorum genera Galli e ſetis equorum inveniere, Hiſpani e liño excuſſoria et pollinaria. Ægyptus e papyro atque junco. *Plin.* lib. xviii. cap. 11.

† At midſummer 1502, machinery for bolting in mills was firſt introduced and employed at Zwikau; Nicholas Boller, who gave riſe to this improvement, being then ſworn maſter of the bakers' company. It may be thence eaſily ſeen, that coarſe and not bolted flour, ſuch as is ſtill uſed in many places, and as was uſed through neceſſity here at Zwikau in 1641, was before that period uſed for baking. *Chronica Cygnea*, or *Deſcription of the town of Zwikau, by Tobias Schmidten*. Zwikau 1656. v. vol. 4to. ii. p. 249. See alſo *Theatri Freibergenſis Chronicon*. Pars poſterior. Freyberg. 1653. 4to. p. 335. Anno 1580, a great drought and ſcarcity of water. Of all the mills round town there were only fifteen going; and in order that the people might be better ſupplied with meal, the bolting-machinery was removed, and this was attended with ſuch good conſequences that each mill could grind as much as before. In Walſer's *Appenzeller Chronik*, 1740. 8vo. p. 471, we are told that about that time (1533) a freeman of Memmingen taught the people of Appenzel to make the beautiful white bolted flour ſo much and ſo far celebrated.

mean that of preparing bolting-cloths, or thoſe kinds of cloth through which meal is ſifted in mills. As this cloth is univerſally uſed, a conſiderable quantity of it is conſumed. For one bolting-cloth, five yards are required; we may allow, therefore, twenty-five to each mill in the courſe of a year. When this is conſidered, it will not appear improbable that the electorate of Saxony, according to a calculation made towards the end of the laſt century, when manufactories of this cloth were eſtabliſhed, paid for it yearly to foreigners from twelve to fifteen thouſand rix-dollars. That kind of bolting-cloth alſo which is uſed for a variety of needle-work, for young ladies' ſamplers, and for filling up the frames of window-ſcreens, &c. is wove after the manner of gauze, of fine-ſpun woollen yarn. One might imagine that this manufacture could not be attended with any difficulty; yet it requires many ingenious operations which the Germans cannot eaſily perform, and with which they are, perhaps, not yet perfectly acquainted. However this may be, large quantities of bolting-cloth are imported from England. It indeed coſts half as much again per yard as the German cloth, but it laſts much longer. A bolting-cloth of Engliſh manufacture will continue good three months, but one of German will laſt ſcarcely three weeks. The wool neceſſary for making this cloth muſt be long, well waſhed, and ſpun to a fine equal thread, which, before it is ſcoured, muſt be ſcalded in hot water

to

to prevent it from ſhrinking. The web muſt be ſtiffened; and in this the Engliſh have an advantage we have not yet been able to attain. Their bolting cloth is ſtiffer as well as ſmoother, and lets the flour much better through it than ours, which is either very little or not at all ſtiffened. The places where this cloth is made are alſo not numerous. A manufactory of it was eſtabliſhed at Oſtra, near Dreſden, by Daniel Kraft, about the end of the laſt century *; and to raiſe him a capital for carrying it on, every mill was obliged to pay him a dollar. Hartau, near Zittau, is indebted for its manufactory to Daniel Pleſsky, a linen-weaver of the latter, who learned the art of making bolting-cloth in Hungary, when on a viſit to his relations, and was enabled to carry it on by the aſſiſtance of a ſchoolmaſter named Strietzel. Since that period this buſineſs has been continued there, and become common †. The cloth which is ſent for ſale, not only every where around the country, but alſo to Bohemia, Moravia, and Sileſia, is wove in pieces. Each piece contains from ſixty-four to ſixty-five Leipſic ells: the narroweſt is ten, and the wideſt fourteen inches in breadth. A piece of the former coſts at preſent from four to about four dollars and a half, and one of the latter ſix dollars. This

* Some information reſpecting this manufacturer may be found in the ſecond and fourteenth volumes of the *Leipziger Samlungen*.

† Tranſactions of the economical ſociety at Leipſic, Michael-maſs 1772. Dreſden, 8vo. p. 79.

cloth,

cloth, it muſt be allowed, is not very white; bu it is not liable to ſpoil by lying in warehouſes. Large quantities of bolting-cloth are made alſo by a company in the duchy of Wurtemberg. At what time this art was introduced there, I cannot ſay: for every thing I know of it I am indebted to a friend, who collected for me the following information in his return through that country. The cloth is not wove in a manufactory, but by eighteen or twenty maſter-weavers, under the inſpection of a company who pay them, and who ſupply all the materials. The company alone have the privilege of dealing in this cloth; and the millers muſt purchaſe from their agents whatever quantity they have occaſion for *. The millers, however, chooſe rather, if they can, to ſupply themſelves privately with foreign and other home-made bolting-cloth, as they complain that the weavers engaged by the company do not beſtow ſufficient care to render their cloth durable: beſides, the perſons employed to carry about this cloth for ſale, often purchaſe ſecretly cloth of an inferior quality in other places, and ſell it as that of the company. Bolting-cloth is made alſo at Gera as well as at Potſdam and Berlin; at the latter of which there is a manufactory of it carried on by the Jews.

* According to the general reſcript of 1750, which has been often renewed. See *Das recht der handwerker nach Wirtembergiſchen geſetzen, entworfen von Weiſſer.* Stutgart, 1779. 8vo. p. 220 and 377. This company obtained that excluſive right ſo early as the year 1668.

For ſome years paſt the French have ſo much praiſed a manner of grinding which they call *mouture économique*, that one might almoſt conſider it as a new invention, that ought to form an epoch in the hiſtory of the miller's art. This art, which however is not new, conſiſts in not grinding the flour ſo fine at once as one may wiſh, and in putting the meal afterwards ſeveral times through the mill, and ſifting it through various ſieves. This method, which in reality has nothing in it either very ingenious or uncommon, was known to the ancient Romans, as we may conclude from the account of Pliny, who names the different kinds of meal, ſuch as *ſimilago*, *ſimila*, *flos*, *pollen*, *cibarium*, &c. for theſe words are not ſynonymous, but expreſs clearly all the various kinds of meal or flour which were procured from the ſame corn by repeated grinding and ſifting. In general, the Romans had advanced very far in this art *; and they knew

* One may eaſily perceive by what Pliny ſays, that the Romans had made a variety of obſervations and experiments on grinding and baking. By comparing his information with what we know at preſent, I have remarked two things, which, as they will perhaps be ſerviceable to thoſe who hereafter may endeavour to illuſtrate Pliny, I ſhall lay before the reader. That author ſays, book xviii. ch. 9. *Quæ ſicca moluntur plus farinæ reddunt; quæ ſalſa aqua ſparſa, candidiorem medullam, verum plus retinent in furfure.* A queſtion here ariſes, whether the corn was moiſtened before it was ground, and whether this was done with freſh or with ſalt water. If Pliny, as is probable, here means a thorough ſoaking, he is not miſtaken; for it is certain that corn which has been expoſed to much wet yields leſs meal, and that the meal, which

knew how to prepare from corn more kinds of meal, and from meal more kinds of bread, than the French have hitherto been able to obtain. Pliny *

which is rather gray or reddiſh than white, will not keep long. The millers alſo are obliged, when corn has been much wetted, to put it through the mill oftener, becauſe it is more difficult to be ground. See *J. C Fulmann, Erfahrungen von der behandlung des zum vermahlen beſtimten getreides.* Leipſic 1778. 8vo. p. 31. *Malouin, Backer-und Müller-Kunſt*, the German tranſlation in *Schauplatz der Künſte*, viii. p 113. and *Harow Abhandlung von Getreidewagen, in Schriften der Naturforſchenden geſelſchaft in Danzig*, i. p. 359. It is true alſo, that when one uſes ſalt water for moiſtening corn, the meal becomes clammier, and is more difficult to be ſeparated from the bran. It is well known that it is not proper to ſteep in ſalt water, malt which is to be ground for beer. On the other hand, a moderate ſoaking, which requires experience and attention, is uſeful, and is employed in preparing the fineſt kinds of flour, ſuch as the Frankfort, Augſburg and Ulm ſpelt-meal, which is exported to diſtant countries. Many excellent rules on this ſubject are given by *Fullmann*, and alſo *(Reyher) Abhandlung von zubereitung der weiſſen ſtarke.* Erfurt 1769. 8vo.

There is another paſſage in the tenth chapter of the ſame book of Pliny, where he ſeems to recommend a thorough ſoaking of corn that is to be ground. *De ipſa ratione piſendi Magonis proponetur ſententia: triticum ante perfundi aqua multa jubet, poſtea evalli, deinde ſole ſiccatum pilo repeti.* I am of opinion that we have here the oldeſt account of the manner of making meal; that is, by pounding. This appears to me probable from the words immediately preceding, which I have above endeavoured to explain, and from the word *evalli.* I do not think that it ought to be tranſlated *to winnow* as Saumaiſe ſays, in *Exercitat. Plinianæ*, p. 907; but agree with Geſner in *Theſaur. Steph.* that it ſignifies to free the corn from the huſk. The corn was firſt ſeparated from the huſks by pounding, which was more eaſily done after the grain had been ſoaked; the ſhelled corn was then ſoaked again, and by thoſe means rendered ſo brittle, that it was eaſily pounded to meal. The like method is employed when people make groats without a mill, only by pounding; a proceſs mentioned by Krunitz in his *Encyclopédie*, vol. ix. p. 805.

* Plin. lib. xviii. c. 10.

reckons that bread ſhould be one-third heavier than the meal uſed for baking it; and that this proportion was uſed in Germany above a hundred years ago, is known from experiments on bread made at different times, which, however uncertain they may have always been, give undoubtedly more bread than meal *. In latter times, the arts of grinding and of baking have declined very much in Italy; and ſenſible Italians readily acknowledge that their bread is much inferior to that of moſt parts of Europe, and that in this reſpect the Germans are their maſters †. Rome indeed forms an exception; for one can procure there as good bread as in Germany; but it is neceſſary to acquaint the reader, that it is not baked by Italians but by Germans; and all the bread and biſcuit baked at Venice in the public ovens, either for home conſumption, the uſe of ſhipping, or for exportation, is the work of German maſters and journeymen. They are called to Venice expreſsly for that purpoſe; and at Rome they form at preſent a company, and have

* Farther information on this ſubject may be found collected in *Krunitz, Encyclopédie*, vol. iii. p. 384. According to experiments mentioned by Kohler in the appendix to his *Rechenmeiſter*, a hundred pounds of meal in Germany produce an hundred and fifty pounds of dough, and theſe an hundred and fifty-three pounds eleven and a half ounces of good bread.

† See the treatiſe of Roſa, profeſſor of medicine at Pavia, on the baking of bread in Lombardy, in *Atti dell' academia delle ſcienze di Siena*, tom. iv. p. 321. Alſo *L'amico de poveri, che inſegna il vero modo di fare il pan venale*. In Firenze 1773. 8vo. See alſo *Phyſikal.-ökon. biblioth.* iv. 365, and v. p. 45.

a very

a very elegant church *. The ovens of theſe German bakers are ſeldom ſuffered to cool, and the greater part of the owners of them become rich; but as through avarice they often continue their labour, without interruption, in the greateſt heat for ſeveral days and nights, ſcarcely one in ten of them lives to return with his wealth to Germany. The Germans have, it is certain, long ſupplied the inhabitants of proud Rome, the metropolis of Catholic Chriſtendom, with bread; for in the fifteenth century it was cuſtomary in all the great families to uſe no other than German bread, as is very circumſtantially related by Felix Fabri, a Dominican monk, who wrote about the end of the above century, and died in 1502 †.

* Schlozers Staatsanzeigen, i. numb. 2. p. 219.

† Italy, the moſt celebrated country in the world, and abundant in grain, has no delicate, wholeſome and pleaſant bread, but what is baked by a German baker, who, by art and induſtrious labour, ſubdues the fire, temperates the heat, and equaliſes the flour in ſuch a manner, that the bread becomes light, fine and delicate; whereas, if baked by an Italian, it is heavy, hard, unwholeſome and inſipid. His holineſs, therefore, prelates, kings, princes and great lords ſeldom eat any bread except what is baked in the German manner. The Germans not only bake well our uſual bread, but they prepare alſo biſcuit for the uſe of ſhips or armies in the time of war, with ſo much ſkill, that the Venetians have German bakers only in their public bake-houſes; and their biſcuit is ſent far and wide over Illyria, Macedonia, the Helleſpont, Greece, Syria, Egypt, Libya, Mauritania, Spain, France, and even to the Orkney Iſlands and Britain, to be uſed by their own ſeamen, or ſold to other nations." *Hiſtoria Suevorum*, lib. i. c. 8. This hiſtory of Felix Fabri may be found in *Suevicarum rerum ſcriptores aliquot ex bibliotheca et recenſione Goldaſti*, printed for the firſt time at Francfort, 1605, 4to. and again at Ulm, 1727, fol.

The *mouture économique* has been long known in Germany. Sabald Muller, in the beginning of the laſt century, gave ſo clear a deſcription of it, that the French even acknowledge it *. This author ſays, that one Butré, who came to Germany to teach the Germans to grind and to bake, was not a little diſconcerted when he found his ſcholars more expert than their officious maſter, and that he met with nothing to conſole him but that, according to his opinion, the mill-ſtones at Carlſruhe were too ſmall, and that the bolting-ſieves were not made in the ſame manner as thoſe at Paris †.

Millers and bakers, even in France, practiſed ſometimes this method of grinding ſo early as the ſixteenth century; but it was ſome time forbidden by the police as hurtful. In the year 1546, thoſe were threatened with puniſhment who ſhould grind their corn twice ‡; and in 1658 this threat was renewed, and the cauſe added, that ſuch a practice was prejudicial to the health ||. Such prohibitions, however,

* Bericht von brodtbacken, fundiret und gerichtet auf die ſubſtanz, natur, eigenſchaft und guttigkeit des fruchtwachs, geſtellet durch Sabaldum Mullern, burgern zu Konigſberg in Preuſſen. Leipſig 1616, 4to. nebſt einigen tabellen. Muller's work is publiſhed alſo in *Arcana et curioſitates œconomicæ*, or Curious ſecrets reſpecting houſekeeping, collected by David Maiern, 1706, 8vo. the place where printed not mentioned.

† Schreber, in his Obſervations on Malouin, ſhews that the mill-ſtones in France are too large.

‡ Traité de la police, par De la Mare, ii. p. 259.

|| Défenſes ſont auſſi faites à tous boulangers, tant maîtres que forains, de

however, made by the police without ſufficient grounds, could not prevent intelligent perſons from remarking that the bran ſtill contained meal, which, when ſeparated from it, would be as proper for food as the firſt. Thoſe who had obſerved this were induced by the probability of advantage, to try to ſeparate the remaining meal from the bran; and the attempt was attended with ſucceſs, but it was neceſſary to keep it concealed. Mulouin relates, that, above a hundred years before, a miller at Senlis employed this method, and that the ſame practice was generally, though privately, introduced at all the mills in the neighbourhood. There were people who made a trade of purchaſing bran in order to ſeparate it from the meal, which they ſold; and it is probable that many of them carried the art too far, and even ground bran along with the meal. This was done chiefly during times of ſcarcity, as in the year 1709. As men in that time were attentive to every advantage, this art was more known and more uſed, ſo that at length it became common. The clergy of the royal chapel

de faire remoudre aucun ſon, pour par après en faire et fabriquer du pain, attendu qu'il ſeroit indigne d'entrer au corps humain, ſur peine de quarante-huit livres Pariſis d'amende. *De la Mare*, p. 228. The following was the true cauſe of this prohibition. As a heavy tax in kind was demanded for all the meal brought to Paris, many ſent thither not meal, but bran abundant in meal, which they cauſed to be ground and ſifted there, and by theſe means acquired no ſmall gain. When the tax was removed, an end was put to this deception, which would otherwiſe have brought the *mouture économique* much ſooner to perfection.

and pariſh church at Verſailles ſent their wheat to be ground at an adjacent mill; it was, according to cuſtom, put through the mill only once, and the bran, which ſtill contained a conſiderable quantity of meal, was ſold for fattening cattle. In time, the miller, having learned the *mouture économique*, purchaſed the bran from theſe eccleſiaſtics, and found that it yielded him as good flour as they procured from the whole wheat. The miller at length diſcovered to them the ſecret, and gave them afterwards fourteen buſhels of flour from their wheat, inſtead of eight which he had given them before. This voluntary diſcovery of the miller was made in 1760, and it is probable that the art was diſcloſed by more at the ſame time. A baker named Maliſſet propoſed to the lieutenant-général de police to teach a method, by which people could grind their corn with more advantage; and experiments were ſet on foot and publiſhed, which proved the poſſibility of it. A mealman of Senlis, named Buquet, who had the inſpection of the mill belonging to the large hoſpital at Paris, made the ſame propoſal; the reſult of his experiments, conducted under the direction of magiſtrates, was printed; the inveſtigation of this art was now taken up by men of learning, who gave it a ſuitable name; and they explained it, made calculations on it, and recommended it ſo much, that the *mouture économique* engaged the attention of all the magiſtrates throughout

throughout France *. Government ſent Buquet to Lyons in 1764, to Bourdeaux in 1766, to Dijon in 1767, and to Mondidier in 1768; and the benefit which France at preſent derives from this improvement is well worth that trouble. Before that period, a Paris *ſetier* yielded from eighty to ninety pounds of meal, and from one hundred and fifty to one hundred and ſixty pounds of bran; but the ſame quantity yields now one hundred and eighty-five, and according to the lateſt improvements one hundred and ninety-five pounds of meal. In the time of St. Louis, from four to five were reckoned neceſſary for the yearly maintenance of a man, and theſe even were ſcarcely ſufficient; ſo many were allowed to the patients in the hoſpital aux Quinze-Vingts; and ſuch was the calculation made by Budée in the ſixteenth century †. When the miller's art was every where improved, theſe four *ſetiers* were reduced to three and a half, and after the lateſt improvements to two ‡.

* Hiſtoire de la vie privée des François, par M. Le Grand d'Auſſy. Paris 1782. 3 vol. 8vo. i. p. 50.

† Budæus de aſſe. Baſiliæ 1556. fol. p. 214.

‡ The principal writers on the mouture économique are the following: *Mémoire ſur les avantages de la mouture économique*, par B. Dijon 1769, 8vo. *Manuel de meunier, et charpentier de moulins; ou Traité de la mouture économique, redigé ſur les mémoires du Sr. Ceſar Buquet:* par M. Beguillet. Paris 1775, 8vo. *Traité de la connoiſſance générale des grains, et de la mouture par économie.* Par M. Beguillet, 1775. 2 vol. 8vo *Pain économique*, par M. de Butré. Carlſruhe 1777, 8vo. *Le parfait boulanger*, par M. Parmentier. Paris 1778, 8vo. See Profeſſor Beckman's Biblioth. x. 74, 79.

Mills

Mills by which grain is only freed from the huſk and rounded, are called barley-mills, and belong to the new inventions. At firſt barley was prepared only by pounding, but afterwards by grinding; and as it was more perfectly rounded by the latter method, it was diſtinguiſhed from that made by pounding by the name of pearl-barley. Barley-mills differ very little in their conſtruction from meal-mills; and machinery for ſtriking barley is generally added to the latter. The principal difference is that the mill-ſtone is rough-hewn around its circumference; and, inſtead of an under ſtone, has below it a wooden caſe within which it revolves, and which, in the inſide, is lined with a plate of iron pierced like a grater, with holes, the ſharp edges of which turn upwards. The barley is thrown upon the ſtone, which, as it runs round, draws it in, frees it from the huſk, and rounds it; after which it is put into ſieves and ſifted *. At Ulm, however, the well-known Ulm barley is ſtruck by a common mill, after the ſtones have been ſeparated a ſufficient diſtance from each other †. The firſt kind of barley-mills is a German invention. In Holland the firſt was erected at Saardam not earlier than the year 1660. This mill, which at firſt was called the Pellikaan, ſcarcely produced in

* Beyers Theatrum machin. molar. p. 85. Sprengels Handwerke und künſte, xii. p. 7.

† Schrebers Beytrage zur beförderung der haußhaltungskunde. Munſter 1776, 8vo. p. 230.

ſeveral

ſeveral years profit ſufficient to maintain a family; but in the beginning of the preſent century there were at Saardam fifty barley-mills, which brought conſiderable gain to their proprietors *.

As long as the natural freedom of man continued unconfined by a multiplicity of laws, every perſon was at liberty to build on his own lands and poſſeſſions whatever he thought proper, and not only water- but alſo wind-mills. This freedom was not abridged even by the Roman law †. But as it is the duty of rulers to conſult what is beſt for the whole ſociety under their protection, princes took care that no one ſhould make ſuch uſe of common ſtreams as might impede or deſtroy their public utility ‡. On this account, no individual was permitted to conſtruct a bridge over any ſtream; and it is highly probable that the proprietors of land, when water-mills began to be nume-

* De pelmoolens zyn in Duytſchlandt uytgevonden, waarvan de eerſte omtrent den jaare 1660 op dit dorp is gebouwt, die men den naam van de Pellikaan gaf. Deſe is'er veele jaaren alleen geweeſt; en't is aanmerkelyk dat toen voor een huyſgeſin daar mede naauwelyks de koſt kon gewonnen worden; daar'er nu wel 50 zyn, waar van de eygenaars alle rykelyk konnen beſtaan. *De koophandel van Amſterdam, door Le Long.* 1727. ii. p. 538.

† Fluminum publicorum communis eſt uſus, ſicuti viarum publicarum et litorum. In his igitur publice licet cuilibet ædificare et deſtruere; dum tamen hoc ſine incommodo cujuſquam fiat. *Digeſtorum* lib. xxxix. tit. 2. 24.

‡ Ait prætor: Ne quid in flumine publico ripave ejus facias, ne quid in flumine publico neve in ripa ejus immittas, quo ſtatio iterve navigio deterior ſit, fiat, *Digeſtor.* lib. xliii. tit. 12. 1.

rous, reſtrained, from the ſame principle, the liberty of erecting them, and allowed them only, when after a proper inveſtigation they were declared to be not detrimental. Water-mills, therefore, were included among what were called *regalia*; and among theſe they are expreſsly reckoned by the emperor Frederic I *. On ſmall ſtreams, however, which were not navigable, the proprietors of the banks might build mills every where along them †.

The avarice of land-holders, favoured by the meanneſs and injuſtice of governments, and by

* In C. L. Tolneri Codex diplomaticus Palatinus, printed with his Hiſtoria Palatina, Francof. ad Moen. 1700, fol. p. 54, there is a diploma of Frederic I, of the year 1159, which contains the following words: "Quia vero ſuperius mentionem de regalibus fecimus, ne quis de eis dubitet, nominatim ea exprimimus. Hæc itaque regalia eſſe dicuntur: moneta, viæ publicæ, aquatilia, flumina, publica molendina, furni, foreſtica, &c." Much to the ſame purpoſe is a paſſage of Gunther's poem *Ligurinus*, which may be found in *Reuberi Scriptores veteres de rebus Cæſarum Germanicorum*. Francof. 1584, fol. p. 408.

Poſtea ſollicite regni de jure vetuſto
Quæſtio mota fuit; quod deſuetudine longa
Priſcus inumbrabat neglecti temporis error.
Ac primum Ligures, ſuper hoc a rege rogati,
Vectigal, portus, cudendæ jura monetæ,
Cumque molendinis, - - - - -
Hæc Ligures ſacro tribuerunt omnia fiſco.

In *Reliquiæ manuſcriptorum ex muſeo J. P. a Ludewig*. Francof. 1720. 8vo. ii. p. 200, we read an inſtance of the emperor Frederic I having forbidden the building of a mill.

† Non autem omne, quod in flumine publico ripave fit, coercet prætor; ſed ſi quid fiat quo deterior ſtatio et navigatio fiat. Ergo hoc interdictum ad ea tantum flumina publica pertinet quæ ſunt navigabilia: ad cætera non pertinet. *Digeſta*. lib. xliii. tit. 11, 12.

the

the weakneſs of the people, extended this regality not only over all ſtreams, but alſo over the air and wind-mills. The oldeſt example of this with which I am at preſent acquainted, is related by Jargow *. In the end of the fourteenth century, the celebrated but long ſince deſtroyed monaſtery of Auguſtines, at Windſheim, in the province of Overyſſel, were deſirous of erecting a wind-mill not far from Zwoll; but a neighbouring lord endeavoured to prevent them, declaring that the wind in that diſtrict belonged to him. The monks, unwilling to give up their point, had recourſe to the biſhop of Utrecht, under whoſe juriſdiction the province had continued ſince the tenth century. The biſhop, highly incenſed againſt the pretender who wiſhed to uſurp his authority, affirmed, that the wind of the whole province belonged to him only; and in 1391, gave the convent expreſs permiſſion to build a wind-mill wherever they thought proper †. In

* Jargow, Einleitung in die lehre von den regalien. Roſtock 1757. 4to. p. 494.

† As our monaſtery had not a mill to grind corn, they reſolved to build a new one. When the Lord of Woerſt heard this, he did every thing in his power to prevent it, ſaying, that the wind in Zealand belonged to him, and that no one ought to build a mill there without his conſent. The matter, therefore, was referred to the biſhop of Utrecht, who, as ſoon as the affair was made known to him, replied in a violent paſſion, that no one had power over the wind within his dioceſe but himſelf and the church at Utrecht; and he immediately granted full power, by letters patent, dated 139, to the convent at Windſheim, to build for themſelves and their ſucceſſors a good wind-mill, in any place which they might find convenient. *Chronicon Canonicorum regularium ordinis Auguſtini, capituli Windeſemenſis; auctore Joh. Buſchio.* Antverpiæ 1621. 8vo. p. 73.

the

the like manner the city of Haerlem obtained leave from Albert count palatine of the Rhine to build a wind-mill in the year 1394*.

Another reſtraint to which men in power ſubjected the weak, in regard to mills, was, that vaſſals were obliged to grind their corn at their lord's mill, for which they paid a certain value in kind. The oldeſt account of ſuch ban-mills, *molendina bannaria*, occurs in the eleventh century. Fulbert, biſhop of Chartres, and chancellor of France, in a letter to Richard duke of Normandy, complains that attempts began to be made to compel the inhabitants of a part of that province to grind their corn at a mill ſituated at the diſtance of five leagues †. In the chronicle of the Benedictine monk Hugo de Flavigny, who lived in the eleventh and twelfth century, we find mention of *molendina quatuor cum banno ipſius villæ* ‡. More examples of this ſervitude, *ſecta ad molendinum*, in the twelfth and thirteenth centuries, may be ſeen in Du Freſne, under the words *molendinum bannale*.

* Albertus——notum facimus——quod donavimus donamuſque—civitati noſtræ Harlemianæ—ventum molarium a parte auſtrali civitatis noſtræ præſcriptæ, Heemſtadium verſus, inter Pacis-foſſam et Sparnam. *Theod. Schrevelii Harlemum.* Lugduni Batavorum 1647. 4to. p. 181.

† This letter of Fulbert may be found in *Maxima bibliotheca veterum patrum.* Lugduni 1677. fol. tom. xviii. p. 9.—quod Baldricus miniſter noſtris hominibus novam angariam induxerit, banniendo ſcilicet ut irent ad molendinum ſancti Audoeni, quinque leucis, ut fertur, ab eorum hoſpitiis remotum.

‡ Chron. Virodunenſe, in Labbei Biblioth. manuſcr. i. p. 132.

It

It is not difficult to account for the origin of theſe ban-mills. When the people were once ſubjected to the yoke of ſlavery, they were obliged to ſubmit to more and ſeverer ſervitudes, which, as monuments of feudal tyranny, have continued even to more enlightened times. De la Mare * gives an inſtance where a lord, in affranchiſing his ſubjects, required of them, in remembrance of their former ſubjection, and that he might draw as much from them in future as poſſible, that they ſhould agree to pay a certain duty, and to ſend their corn to be ground at his mill, their bread to be baked in his oven, and their grapes to be preſſed at his wine-preſs. The origin of theſe ſervitudes may, however, be accounted for on juſter grounds. The building of mills was, at all times, expenſive, and undertaken only by the rich, who, to indemnify themſelves for the money expended in order to benefit the public, ſtipulated that the people in the neighbourhood ſhould grind their corn at no other mills than thoſe erected by them. At preſent, when every method deviſed to prevent the deception of millers has been found inſufficient, it

* Thomas, abbé de Saint Germain des Prez, ſous le regne de Saint Louis accorda (la manumiſſion ou affranchiſſement) aux habitans d'Antony, de Verrieres et de Maſſy, au mois de Juin 1248, à la charge de cent livres Pariſis de rente, et des droits de bannalité: *ut coquant ad furna noſtra, molant ad molendina, et premant ad torcularia noſtra.* Ce ſont les termes des patentes qui en furent expediées, et qui ſont conſervées dans les archives de cette abbaye. *Traité de la police*, ii. p. 151.

is much to be wiſhed that theſe ban-mills were abo-liſhed, and that the number of free mills were in-creaſed.

VERDIGRISE, OR SPANISH GREEN.

RESPECTING the preparation of verdigriſe, various and in part contradictory opinions have been entertained; and at preſent, when it is with certainty known, it appears that the proceſs is al-moſt the ſame as that employed in the time of Theophraſtus, Dioſcorides, and Vitruvius *. At that period, however, every natural green copper calx was comprehended under the name of *ærugo*. Dioſcorides and Pliny ſay expreſsly, that a ſub-ſtance of the nature of thoſe ſtones which yielded copper when melted, was ſcraped off in the mines of Cyprus; as is ſtill practiſed in Hungary, where the outer coat of the copper ore is collected in the like manner, and afterwards purified by being waſhed in water †. Another ſpecies, according to the account of Dioſcorides, was procured from the water of a grotto in the ſame iſland; and the moſt ſaleable natural verdigriſe is ſtill collected by

* Dioſcorid. lib. v. cap. 91, 92. Theophraſtus de lapidibus, edit. Heinſii, p. 399. Plin. lib. xxxiv. cap. 11, 12. Oribaſius, Medic. col-lect. lib. xiii. Stephani Medicæ artis principes, p. 453. Vitruv. lib. vii. cap. 12.

† Bruckmann, Epiſtolæ itinerar. cent. i. p. 76.

ſimilar

ſimilar method in Hungary. The clear water which runs from old copper works is put into large veſſels, and after ſome time the green earth falls to the bottom as a ſediment *.

The artificial *ærugo* of the ancients, however, was our verdigriſe, or copper converted into a green calx by vinous acid. To diſcover the method of procuring this ſubſtance could not be difficult, as that metal contracts a green ruſt oftener than is wiſhed, when in the leaſt expoſed to acids. The ancients, for this purpoſe, uſed either veſſels and plates of copper, or only ſhavings and filings †; and the acid they employed was either the ſoureſt vinegar ‡, or the ſour remains left when they made wine: ſuch as grapes become ſour, or the ſtalks and ſkins after the juice had been preſſed from them §. Sometimes the copper was only expoſed to the vapour of vinegar in cloſe veſſels, ſo that it did not come into immediate contact with

* Delius, Anleitung zur Bergbaukunſt. Wien 1773. 4to. p. 425.

† Dioſcorides: λεπιδα, ρινισματα. Plinius: *Squamæ, delimata æris ſcobs.*

‡ Dioſcorides: Ὀξος δριμυτατον.

§ Plinius: *vinacea.* Dioſcorides: ϛεμφυλα. Theophraſtus: τρυξ. The laſt word has various meanings: ſometimes it ſignifies ſqueezed grapes; ſometimes wine lees, &c. of which Niclas gives examples, in his Obſervations on *Geop.* lib. vi. c. 13. p. 457; but it can never be tranſlated by *amurca*, though that word is uſed by Furlanus, the tranſlator of Theophraſtus. The old gloſſary ſays, Αμοργη, ϛιν δε τρυξ ελαιου. Oil, however, has nothing to do with verdigriſe.

it; in the ſame manner as was practiſed with plates of lead in the time of Theophraſtus, when white-lead was made, and as is ſtill practiſed at preſent. Sometimes the metal was entirely covered with vinegar, or frequently beſprinkled with it, and the green ruſt was from time to time ſcraped off*; and ſometimes copper filings were pounded with vinegar in a copper mortar till they were changed into the wiſhed-for green calx. This article was frequently adulterated, ſometimes with ſtones, particularly pumice-ſtone reduced to powder, and ſometimes with copperas†. The firſt deception was eaſily diſcovered; and to detect the ſecond, nothing was neceſſary but to roaſt the verdigriſe, which betrayed the iron by becoming red; or to add to the verdigriſe ſome gall nut, the aſtringent particles of which, united with the ferruginous vitriol of the copperas, formed an ink, which communicated a black colour to paper dipped into it.

In early periods verdigriſe was uſed principally for making plaſters, and for other medicinal purpoſes; but it was employed alſo as a colour, and on that account it is by Vitruvius reckoned among the pigments. When applied to the former purpoſe it appears that the copper calx was mixed with various ſalts and other ingredients. One mixture of this kind was called vermicular

* This kind was called therefore ἰος ξυστος, æruginis raſilis.

† Χαλκανθος, atramentum ſutorium.

verdigriſe,

verdigriſe *, the accounts of which in ancient authors ſeem to ſome commentators to be obſcure; but in my opinion we are to underſtand by them that the ingredients were pounded together till the paſte they formed aſſumed the appearance of pieces or threads like worms; and that from this reſemblance they obtained their name. For the ſame reaſon the Italians give the name of *vermicelli* to wire-drawn paſte of flour uſed in cookery †. When the proceſs for making this kind of verdigriſe did not ſucceed, the workmen frequently added gum to it, by which the paſte was rendered more viſcous; but this mixture is cenſured both by Pliny and Dioſcorides. It appears that the greater part of the verdigriſe in antient times was made in Cyprus, which was celebrated for its copper works, and in the iſland of Rhodes.

At preſent the greater part of our verdigriſe is manufactured at Montpellier in France, and by proceſſes more advantageous than thoſe known to the ancients. The dried ſtalks of grapes are ſteeped in ſtrong wine, and with it brought to a ſour fermentation. When the fermentation has ceaſed, they are put into an earthen pot, in alternate lay-

* Ιος σκωληξ, ærugo ſcolacea, *or* vermicularis.

† Should this explanation be juſt, we ought for *æruca*, the name given by Vitruvius to verdigriſe, to read *eruca*: though the conjecture of Marcellus Vergilius (*Dioſcorides, interprete Mar. Vergilio.* Coloniæ 1529. fol. p. 656), that the reading ſhould be *æuca* or *ærea*, is no leſs probable; for by this epithet its difference from *ærugo ferri* was frequently diſtinguiſhed.

ers with plates of copper, the ſurface of which, in a few days, is corroded by the vinous acid, and the calx is then ſcraped off *. The manufacturers of this article uſe only Swediſh copper, for which they ſend to Hamburgh; and it is believed that no wine is ſo proper for the above purpoſe as that of Languedoc. However this may be, it is certain that, even in the fifteenth century, the making of verdigriſe was an old and profitable branch of commerce in France. The city of Montpellier having been obliged to expend large ſums in erecting more extenſive buildings to carry it on, and having had very ſmall profits for ſome years before, received, by letters patent from Charles VI, in 1411, permiſſion to demand ſixteen ſous for every hundred weight of verdigriſe made there †. In latter times, this trade has decayed very much. Between the years 1748 and 1755 from nine to ten thouſand quintals were manufactured annually, by which the proprietors had a clear profit of 50,000 crowns; but a ſudden change ſeems to have taken place, for in 1759 the quantity manufactured was eſtimated at only three thouſand quintals. This quantity required 630 quintals of copper, valued at 78,750 livres: the expences of labour amounted to 1,323 livres; the neceſſary quantity

* The lateſt writers on this art are mentioned in Weigel's Chemie, p. 527. and Krunitz, Oekonom. Encycloped. xx. p. 241.

† This is mentioned by Serane in his treatiſe, a tranſlation of which may be found in *Mineralogiſchen Beluſtigungen*, ii. p. 251.

of

of wine, 1033 meaſures, to 46,485 livres, and extraordinaries to 10,330 livres; ſo that the three thouſand quintals coſt the manufacturers about 136,888 livres. In the year 1759 the pound of verdigriſe ſold for nine ſous ſix deniers: ſo that the three thouſand quintals produced 142,500 livres, which gave a neat profit of only 5612 livres*. Other nations, who till that period had purchaſed at leaſt three-fourths of the French verdigriſe, made a variety of experiments in order to diſcover a method of corroding copper by mineral acid, which might be cheaper; and ſome have ſo far ſucceeded that they can ſupply themſelves without the French paint in caſes of neceſſity. As one inſtance, I ſhall mention only the verdigriſe manufactured by Gravenhorſt and brothers at Brunſwick.

In commerce there is a kind of this ſubſtance known under the name of diſtilled verdigriſe, which properly is nothing elſe than verdigriſe purified, and ſomewhat cryſtallized by being again diſſolved in vinegar. This article has been hitherto manufactured by the Dutch, and affords an additional example of the induſtry of that people. Formerly, there was only one perſon at Grenoble acquainted with this art, which he kept ſecret and practiſed alone; but for ſome years paſt there have been three manufactories of the ſame

* Journal œconom. 1759. p. 311.

kind at Montpellier, and another has been eſtabliſhed at Paris by Baumé *.

The German name of verdigriſe (*ſpangrün*) has by moſt authors been tranſlated Spaniſh green; and it has thence been concluded that we received that paint firſt from the Spaniards. This word and the explanation of it are both old; for we find *ærugo*, and *viride Hiſpanicum*, tranſlated *Spangrün*, *Spongrün*, or *Spanſgrün*, in many of the earlieſt dictionaries †, ſuch as that printed in 1480 ‡. For this meaning, however, I know no other proof than the above etymology, which carries with it very little probability; and I do not remember that I ever read in any other works that verdigriſe firſt came from the Spaniards.

SAFFRON.

THAT the Latin word *crocus* ſignified the ſame plant which we at preſent call ſaffron, and which, in botany, ſtill retains the ancient name, has, as

* An account of the method of making diſtilled verdigriſe may be found in the following works: *L'Art du diſtillateur d'eaux-fortes, par Demachy*. Paris 1773. fol. p. 168. *Mémoires de l'Academ. des Sciences à Paris, année* 1776. p. 724.

† Friſch's Worterbuch, p. 291. In the works of *George Agricola*, printed together at Baſle 1546, fol. we find in page 473, where the terms of art are explained: *Ærugo*, Grünſpan, or Spanſch-grün, *quod primo ab Hiſpanis ad Germanos ſit allata*; *barbari nominant* viride æris.

‡ By Conrad Zeninger Nuremberg. In that ſcarce work, *Joſua Maaler, Teutſche Sprach* oder *Dictionarium Germano-Latinum*, Zurich 1561, 4to. *ærugo* is called Spangrüne.

far

far as I know, never been doubted; and indeed I know no reaſon why it ſhould, however miſtruſtful I may be when natural objects are given out for thoſe which formerly had the like names. The moderns often apply ancient names to things very different from thoſe which were known under them by the Greeks and the Romans: but what we read in ancient authors reſpecting *crocus* agrees, in every reſpect, with our ſaffron, and can ſcarcely be applied to any other vegetable production. *Crocus* was a bulbous plant, which grew wild in the mountains. There were two ſpecies of it, one of which blowed in ſpring, and the other in autumn. The flowers of the latter, which appeared earlier than the green leaves that remained through the winter, contained thoſe ſmall threads or filaments which were uſed as a medicine and a paint, and employed alſo for ſeaſoning various kinds of food *.

It appears that the medicinal uſe, as well as the name of this plant, has always continued among the Orientals; and the Europeans, who adopted the medicine of the Greeks, ſent to the Levant for

* Plin. lib. xxi. cap. 6. Geopon. lib. xi. cap. 26. and Theophraſt. Hiſtor. plant. lib. vi. cap. 6; where Joh. Bod. von Stapel, p. 661. has collected, though not in good order, every thing to be found in the ancients reſpecting ſaffron. The ſmall aromatic threads, abundant in colour, the only parts of the whole plant ſought after, were by the Greeks called γλωχινες, κροκιδες, or τριχες; and by the Romans *ſpicæ*. They are properly the end of the piſtil, which is cleft into three diviſions. A very diſtinct repreſentation of this part of the flower may be ſeen in plate 184 of Tournefort's *Inſtitut. rei herbariæ*.

ſaffron *, until they learned the art of rearing it themſelves; and employed it very much until they were made acquainted with the uſe of more beneficial articles, which they ſubſtituted in its ſtead. Thoſe who are deſirous of knowing the pharmaceutical preparation of ſaffron, and the diſeaſes in the curing of which it was employed, may read Hertodt's *Crocologia*, where the author has collected all the receipts, and even the ſimpleſt, for preparing it †.

What in the ancient uſe of ſaffron is moſt diſcordant with our taſte, at preſent, is the employing it as a perfume. Not only were halls, theatres, and courts, through which one wiſhed to diffuſe an agreeable ſmell, ſtrewed with this plant ‡, but it entered into the compoſition of many vinous extracts, which retained the ſame ſcent; and theſe coſtly ſmelling waters were often made to flow in ſmall ſtreams, which ſpread abroad their much-admired odour §. Luxurious people even moiſtened

* On this account we often find in preſcriptions: *Recipe croci Orientalis* - - - -

† Crocologia, ſeu curioſa croci enucleatio, congeſta a J. F. Hertodt. Jenæ 1670. 8vo.

‡ See Beroald's Obſervations on the 54th chapter of the Life of Nero by Suetonius. Spartian, in the Life of Adrian, chap. 19, ſays: Romæ poſt cæteras immenſiſſimas voluptates in honorem ſocrus ſuæ, aromatica populo donavit. In honorem Trajani balſama et crocum per gradus theatri fluere juſſit.

§ Lucan, in the ninth book of his Pharſalia, verſe 809, deſcribing how the blood flows from every vein of a perſon bit by a kind of ſerpent

ened or filled with them all thoſe things with which they were deſirous of ſurpriſing their gueſts in an agreeable manner *, or with which they ornamented their apartments. From ſaffron, with the addition of wax and other ingredients, the Greeks as well as the Romans prepared alſo ſcented ſalves, which they uſed in the ſame manner as our anceſtors their balſams †.

Notwithſtanding the fondneſs which the ancients ſhewed for the ſmell of ſaffron, it does not appear that in modern times it was ever much eſteemed. As a perfume, it would undoubtedly be as little reliſhed at preſent, as the greater part of the diſhes of Apicius, fricaſſees of ſucking puppies ‡, ſauſages, and other parts of ſwine, which one could not even mention with decency in gen-

pent found in Africa, ſays, that it ſpouts out in the ſame manner as the ſweet-ſmelling eſſence of ſaffron iſſues from the limbs of a ſtatue.

Utque ſolet pariter totis ſe effundere ſignis
Corycii preſſura croci; ſic omnia membra
Emiſere ſimul rutilum pro ſanguine virus.

* Omnes placentæ omniaque poma, etiam minima vexatione contacta, cœperunt effundere crocum. *Petron. Satyr.* cap. 60.

† Of the method of preparing this ſalve or balſam, mentioned by Athenæus, Cicero, and others, an account is to be found in Dioſcorides, lib. i. c. 26.

‡ Catulos lactentes adeo puros exiſtimabant ad cibum, ut etiam placandis numinibus hoſtiarum vice uterentur his. Genitæ Manæ catulo res divina ſit, et in cœnis Deum etiamnum ponitur catulina. Aditialibus quidem epulis celebrem fuiſſe, Plauti fabulæ indicio ſunt. *Plin.* lib. xxix. cap. 4. And Feſtus ſays: Catulinam carnem eſitaviſſe, hoc eſt comediſſe, Romanos, Plautus in Saturione refert.

teel company *; though it certainly has the ſame ſcent which it had in the time of Ovid, and although our organs of ſmelling are in nothing different from thoſe of the Greeks and the Romans. From parts of the world to them unknown we have, however, obtained perfumes which far excel any with which they were acquainted. We have new flowers or, at leaſt, more perfect kinds of flowers long known, which, improved either by art or by accident, are ſuperior in ſmell to all thoſe in the gardens of the Heſperides, of Adonis and Alcinous, ſo much celebrated. We have learned the art of mixing perfumes with oils and ſalts, in ſuch a manner as to render them more volatile, ſtronger, and more pleaſant; and we know how to obtain eſſences ſuch as the ancient voluptuaries never ſmelt, and for which they would undoubtedly have given up their ſaffron. The ſmelling-bottles and perfumes which are often preſented to our beauties, certainly far excel that promiſed by Catullus to a

* Martial, b. xiii. ep. 43. praiſes a cook who dreſſed the dugs of a ſow with ſo much art and ſkill, that it appeared as if they ſtill formed a part of the animal, and were full of milk:

Eſſe putes nondum ſumen; ſic ubere largo
Effluit, et vivo lacte papilla tumet.

A diſh of this ſort is mentioned by *Apicius de arte coquin.* lib. vii. cap. 2. The ſame author gives directions, book vii. chap. i. for cooking that delicious diſh of which Horace ſays, ep. i. 15. 41, *nil vulva pulchrius ampla.* Farther information on this ſubject may be found in the notes to Pliny's Epiſtles, lib. i. 15; *Plin.* lib. xi. c 37. Martial. Epig. xiii. 56; and, above all, in *Joh. Pet. Lotticchii Commentar. in Petronium*, lib. i. cap. 18.

friend,

friend, with the aſſurance that his miſtreſs had received it from Venus and her Cupids, and that when he ſmelt it he would wiſh to become all noſe :

Nam unguentum dabo quod meæ puellæ
Donarunt Veneres Cupidineſque,
Quod tu quom olfacies, deos rogabis,
Totum ut te faciant, Fabulle, naſum.

It cannot, however, be denied that both taſte and ſmell depend very much on imagination. We know that many articles of food, as well as ſpices, are more valued on account of their ſcarcity and coſtlineſs than they would otherwiſe be. Hence things of leſs value, which approach near to them in quality, are ſought after by thoſe who cannot afford to purchaſe them ; and thus a particular taſte or ſmell becomes faſhionable. Brandy and tobacco were at firſt recommended as medicines ; they were, therefore, much uſed, and by continual habit people at length found a pleaſure in theſe ſharp and almoſt nauſeating articles of luxury. Subſtances which gratify the ſmell become, nevertheleſs, like the colour of clothes, oft unfaſhionable when they grow too common. Certain ſpiceries, in which our anceſtors delighted, are inſupportable to their deſcendants, whoſe nerves are weak and more delicate ; and yet many of the preſent generation have accuſtomed themſelves to ſtrong ſmells of various kinds, by gradually uſing them more and more, till they have at length become indiſpenſable

indiſpenſable wants. Some have taken ſnuff rendered ſo ſharp by ſalts, antimony, ſugar of lead, and other poiſonous drugs, that the olfactory nerves have been rendered callous, and entirely deſtroyed by it.

That ſaffron was as much employed in ſeaſoning diſhes as for a perfume, appears from the oldeſt work on cookery which has been handed down to us, and which is aſcribed to Apicius. Its uſe, in this reſpect, has been long continued, and, in many countries, is ſtill more prevalent than phyſicians wiſh it to be. Henry Stephen ſays, "Saffron muſt be put in all Lent ſoups, ſauces and "diſhes: without ſaffron we cannot have well-"cooked peas *."

It may readily be ſuppoſed that the great uſe made of this plant in cookery muſt have induced people to attempt to cultivate it in Europe; and, in my opinion, it was firſt introduced into Spain by the Arabs, as may be conjectured from its name, which is Arabic, or rather Perſian †. From Spain

* Le ſaffran doit être mis en tous les potages, ſauces et viandes quadragéſimales. Sans le ſaffran, nous n'aurions jamais bonne purée, bon pois paſſés, ni bonne ſauce. *Apologie pour Herodote, par H. Eſtienne.* A la Haye 1735. 2 vol. 8vo.

† Meninſki in his Turkiſh Lexicon, p. 2448 of the old edition, has *Zae' feran*, crocus. Golius in his Dictionary gives it as a Perſian word. That much ſaffron is ſtill cultivated in Perſia, and that is of the beſt kind, appears from Chardin. See his Travels, printed at Rouen 1723. 10 vol. 12mo. iv. p. 37. That the Spaniards borrowed the word

Spain it was, according to every appearance, carried afterwards to France, perhaps to Albigeois, and thence diſperſed into various other parts *. Some travellers alſo may, perhaps, have brought bulbs of this plant from the Levant. We are, at leaſt, aſſured that a pilgrim brought from the Levant to England, under the reign of Edward III, the firſt root of ſaffron, which he had found means to conceal in his ſtaff, made hollow for that purpoſe †. At what period this plant began to be cultivated in Germany I do not know; but that this was firſt done in Auſtria, in 1579, is certainly falſe. Some ſay that Stephen von Hauſen, a native of Nuremberg, who, about that time, accompanied the imperial ambaſſador to Conſtantinople, brought the firſt bulbs to Vienna, from the neigh-

word *ſafran* from the Vandals is much more improbable. It is to be found in *Joh. Marianæ Hiſtor. de rebus Hiſpaniæ.* Hagæ 1733. fol. i. p. 147. The author, ſpeaking of foreign words introduced into the Spaniſh language, ſays, Vandalis aliæ voces acceptæ feruntur, *camara, azafran*, &c.

* Cours complet d'agriculture, redigé par Rozier, Paris 1781. 4to. i. p. 266.

† It is reported at Saffron-Walden, that a pilgrim, propoſing to do good to his country, ſtole an head of ſaffron, and hid the ſame in his palmer's ſtaff, which he had made hollow before on purpoſe, and ſo he brought this root into this realm, with venture of his life; for if he had been taken, by the law of the country from whence it came, he had died for the fact. *Voyages collected by Hakluyt*, vol. ii. p. 164. The ſame thing, extracted from *Harriſon's Hiſtory of Britain*, book iii. chap. 14, is related in *The Political Survey of Britain, by J. Campbell.* London 1774. 4to. ii. p. 101.

bourhood

bourhood of Belgrade *. This opinion is founded on the account of Cluſius, who, however, does not ſpeak of the autumnal ſaffron uſed as a ſpice, but of an early ſort, eſteemed on account of the beauty of its flowers †. Cluſius has collected more ſpecies of this plant than any of his predeceſſors; and has given an account by whom each of them was firſt made known.

In the fifteenth and following century, the cultivation of ſaffron was ſo important an article in the European huſbandry, that it was omitted by no writer on that ſubject; and an account of it is to be found in Creſcentio ‡, Serres §, Hereſbach ||, Von Hohberg ¶, Florinus **, and others. In thoſe periods, when it was an important object of trade, it was adulterated with various and in part noxious

* Breſlauer Samlung, 1720. November, p. 556.

† Sexta ſpecies primum Germaniæ innotuit poſt annum 1579, *Stephani van Huyſen* Noribergenſis diligentia, qui ejus anni initio Conſtantinopoli rediens in comitatu generoſi viri *Ulrichi a Kunnigsperg* (qui præcedente anno honorarium eo tulerat) in Servia, ſive Mœſia ſuperiore, ſub Belgrado florentem eruit, Martio menſe. *Cluſii Rar. plant. hiſt.* Antwerp 1601. fol. p. 207.

‡ Pietro Creſcentio d'agricoltura. In Venetia 1542. 8vo. lib. vi. cap. 25.

§ Le théatre d'agriculture et meſnage des champs, d'Olivier de Serres. Seconde edit. Paris 1603. 4to. p. 662.

|| Rei ruſticæ libri quatuor, conſcripti a Conr. Hereſbachio. Spiræ Nemetum 1595. 8vo. p. 252.

¶ Georgica curioſa.

** Oeconomus prudens et legalis.

ſubſtances;

ſubſtances; and attempts were made in ſeveral countries to prevent this impoſition by ſevere penalties. In the year 1550, Henry II, king of France, iſſued an order for the expreſs purpoſe of preventing ſuch frauds, the following extract from which will ſhew ſome of the methods employed to impoſe on the public in the ſale of this article *: "For ſome time paſt," ſays the order, "a certain quantity of the ſaid ſaffron has been found "altered, diſguiſed, and ſophiſticated, by being "mixed with oil, honey, and other mixtures, in "order that the ſaid ſaffron, which is ſold by "weight, may be rendered heavier; and ſome add "to it other herbs, ſimilar in colour and ſubſtance to beef over-boiled, and reduced to "threads, which ſaffron, thus mixed and adulterated, cannot be long kept, and is highly prejudicial to the human body; which, beſides the ſaid "injury, may prevent the above-ſaid foreign merchants from purchaſing it, to the great diminution of our revenues, and to the great detriment "of foreign nations, againſt which we ought to "provide," &c.

* The whole order may be ſeen in *Traité de Police, par De la Mare*, iii. p. 428.

ALUM.

THIS ſubſtance affords a ſtriking inſtance how readily one may be deceived in giving names without proper examination. Our alum was certainly not known to the Greeks or the Romans; and what the latter called *alumen* * was vitriol; not, however, pure vitriol, but ſuch as forms itſelf in mines, and which is often nothing elſe than vitriolic earth. To thoſe who know how deficient the ancients were in the knowledge of ſalts, and of mineralogy in general, this aſſertion will without farther proof appear highly probable. Alum and vitriol are neutral ſalts, or, to ſpeak more correctly, ſaline ſubſtances, which have a very cloſe affinity. Both contain the ſame acid called the vitriolic; both have a ſtrong aſtringent quality, and on this account are often comprehended under the common name of ſtyptic ſalts. Both are alſo not only found in the ſame places, but are frequently obtained from the ſame minerals; and both can be ſometimes employed in the like manner, and for the ſame purpoſes. The difference, that vitriol is combined with a metallic earth, either that of iron, copper or zink, and alum on the other hand

* What the Romans called *alumen* was by the Greeks called στυπτηρια.

with

with a peculiar white earth, called therefore alum-earth, has been eſtabliſhed only in modern times.

A ſtronger proof, however, in favour of my aſſertion is what follows: The Greeks and the Romans ſpeak of no other than natural alum; but our alum is ſeldom produced ſpontaneouſly in the earth, and ſeveral of our moſt accurate mineralogiſts, ſuch as Scopoli and Sage *, deny the exiſtence of natural alum. Real alum cryſtals are formed very rarely, on minerals which abound in a great degree with aluminous particles, when they have been expoſed a ſufficient time to the open air and the rain †; and even then they are ſo ſmall and ſo much ſcattered, that it requires an experienced and attentive obſerver to know and diſcover them. The ſmalleſt trace of alum-works is not to be found in the ancients, nor even of works for making vitriol, except what is mentioned by Pliny, who tells us that blue vitriol was made in Spain, by the proceſs of boiling; and this circumſtance he conſiders as the only one of its kind, and ſo ſingular, that he is of opinion no other ſalt could

* Examen chymique de différentes ſubſtances minerales, par M. Sage: or my tranſlation *Chemiſche unterſuchung einiger mineralien*. Gottingen 1775. 8vo. p. 148.

† Some cryſtals of this kind were obſerved by Linnæus and Morand. See the Travels of the former through Scandinavia, p. 291, and the account of the latter in my *Phyſical.-ökonom. Bibliothek*, iii. p. 469.

be obtained in the ſame manner *. Beſides, every thing related by the ancients of their alum agrees perfectly with natural vitriolic ſubſtances: but to deſcribe them all might be difficult; for they do not ſpeak of pure cryſtals, but of ſaline bodies, which nature of itſelf exhibits in various ways, and under a variety of forms; and every ſmall difference in the colour, the exterior or interior conformation, however accidental, provided it could be clearly diſtinguiſhed, was to them ſufficient to make a diſtinct ſpecies, and to induce them to give it a new name †.

The celebrity which the ancient alum had, as a ſubſtance extremely uſeful in dyeing and medicine, was entirely forgotten when the alum of the moderns became known; but this celebrity was again revived when it was diſcovered that real alum could be often made from vitriolic minerals; or that where the latter are found there are generally minerals which abound with it. In many of theſe places alum-works have, in the courſe of time, been erected: and this circumſtance has ſerved in ſome meaſure to ſtrengthen the opinion that the alum

* Nec ullius æque mira natura eſt. *Plin.* lib. xxxiv. c. 12. The ſame account is given by *Iſidor. Origin.* lib. xvi. c. 2. and by *Dioſcorides*, lib. v. c. 114. The latter, however, differs from Pliny in many circumſtances.

† Thoſe who are deſirous of ſeeing every thing that the ancients have left us reſpecting their alum may conſult *Aldrovandi Muſeum metallicum*, and *Bernardi Caſii Mineralogia*. Lugduni 1636. fol. p. 334.

of

of the ancients and that of the moderns are the ſame ſalt; becauſe where the former was found in ancient times, the latter has ſince been procured by a chemical proceſs. Some hiſtorians of the fifteenth century even ſpeak of the alum-works erected at that period, as if the art of making this ſalt had only been revived in Europe.

The ancients procured their alum from various parts of the world. Herodotus mentions Egyptian alum; for he tells us that, when the people of Delphos, after loſing their temple by a fire, were collecting a contribution in order to rebuild it, Amaſis king of Egypt ſent them a thouſand talents of alum *. In Pliny's time the Egyptian alum was accounted the beſt. It is well known that real alum is reckoned among the exports of Egypt at preſent †; but I am acquainted with no author who mentions the place where it is found or made, or who has deſcribed the method of preparing it.

The iſland of Melos, now called Milo, was particularly celebrated on account of its alum, as we learn from Diodorus Siculus, Celſus, Pliny and others, though none was to be found there in the time of Diodorus ‡. This natural vitriol has been

* Αμασις, μεν γαρ σφι εδωκε χιλια, συμπηρης, ταλαντα. Herodot. lib. ii. c. 180. Franc. 1608. fol.

† A catalogue of the Egyptian articles of commerce may be found in *Nouvelle relation d'un voyage fait en Egypte*, par le P. Vanſleb, Paris 1677, 12mo. p. 204.

‡ Diodor. Sic. lib. v. ed. Weſſelingii, i. p. 338.

obſerved in the grottos of that iſland by ſeveral modern travellers, ſuch as Tournefort * and Matthews †, who very properly conſider it as the real alum of the ancients.

The iſlands of Lipara and Strongyle, or, as they are called at preſent, Lipari and Stromboli, contained ſo great a quantity of this ſubſtance, that the duty on it brought a conſiderable revenue to the Romans ‡. At one period, Lipari carried on an excluſive trade in alum, and raiſed the price of it at pleaſure; but in that iſland, at preſent, there are neither vitriol- nor alum-works ||. Sardinia, Macedonia and Spain, where alum was found formerly, produce ſtill a ſalt known under that name §.

When our alum became known, it was conſidered as a ſpecies of the ancient; and as it was purer, and more proper to be uſed on moſt occaſions, the

* Tournefort, Voyage, i. p. 63.

† Matthews's Travels may be found in the German tranſlation of Blainville's. Lemgo 1767. vol. v. p. 445, 446. There is alſo a French tranſlation of them intitled *Voyage en France, en Italie et aux iſles de l'Archipel en* 1750, *traduit de l'Anglois*. Paris 1763. four vol. 4to. Some information reſpecting the ſame ſubject may be ſeen in that expenſive but uſeful work, *Voyage pittoreſque de la Grèce*, i. p. 12.

‡ Diodor. Sic. lib. c. Strabo, lib. vi. edit. Almel. p. 423.

|| See Deodat. de Dolomieu, Reiſe nach den Lipariſchen Inſeln. Leipzig 1783. 8vo. p. 80.

§ Copious information reſpecting the Spaniſh alum-works may be found in *Introduccion à la hiſtoria natural y à la geografia fiſica de Eſpagna*, par D. Guil. Bowles; preliminary diſcourſe, page 39. and in Travels through Spain, by Dillon, London 1780. 4to. p. 227.

name

name of alum * was ſoon appropriated in a particular manner to it alone. The kinds of alum however known to the ancients, which were real vitriol, maintained a preference in medicine and for dyeing black; and on this account, theſe impure ſubſtances have been ſtill retained in druggiſts' ſhops under the name of *miſy*, *ſory*, &c. But a method was at length found out of forming them into a lye, and of procuring thence cryſtalliſed martial ſalts, which obtained the new name of *vitriol*. This appellation had its riſe firſt in the eleventh or twelfth century; at leaſt I know no writer older than Albertus Magnus † by whom it is mentioned or uſed. Agricola ‡ conjectures that it was occaſioned by the

* The derivation of the Latin name *alumen*, which, if I miſtake not, occurs firſt in Columella and Pliny, is unknown. Some deduce it from ἅλμη; others from αλειμμα; and Iſiodorus gives a derivation ſtill more improbable. May it not have come from Egypt with the beſt ſort of alum? Had it originated from a Greek word, it would undoubtedly have been formed from συπτηρια. This appellation is to be found in Herodotus; and nothing is clearer than that it has ariſen from the aſtringent quality peculiar to both the ſalts, and alſo from συφειν, as has been remarked by Dioſcorides, Pliny and Galen. The latter ſays, Τουτου του φαρμακου και τ'ουνομα παρωνομασαι τη συφει, σφοδροτατην, γαρ αυτην εχει. This drug has acquired its name from (τη συφει) aſtringency, becauſe it poſſeſſes that quality in a high degree. *Galenus de ſimp. medicam. facultat.* lib. ix. c. 3. 30. See alſo *G. J. Voſſii Etymologicon linguæ Latinæ*, Neapoli 1762, fol. p. 30.

† Viride etiam, quod a quibuſdam vitreolum vocatur. *Alberti Magni Opera omnia.* Lugduni 1651.

‡ G. Agricola, lib. iii. de nat. foſſilium. Baſiliæ 1546. fol. p. 219.

likeneſs which the cryſtals of vitriol had to glaſs. This is alſo the opinion of Voſſius * ; and it is very ſingular that Pliny ſays nearly the ſame thing; for he obſerves, ſpeaking of blue vitriol, the only kind then known, that one might almoſt take it for glaſs †.

By enquiring into the uſes to which the ancients applied their alum, I find that it was ſometimes employed to ſecure wooden buildings againſt fire. This remark I have here introduced to ſhew that this idea, which in modern times has given occaſion to many expenſive experiments, is not new. Aulus Gellius ‡ relates, from the works of an hiſtorian now loſt, that Archelaus, one of the generals of Mithridates, waſhed over a wooden tower with a ſolution of alum, and by theſe means rendered it ſo much proof againſt fire, that all Sylla's attempts

* Atramentum ſutorium variis coloribus præditum eſt; - - - candidum potiſſimum ſtiriæ figura reperitur Goſlariæ, tranſlucidum cryſtalli inſtar; nec cæruleum nec viride caret perſpicuitate; unde ſuperior ætas atramento ſutorio vitrioli nomen impoſuit. *Voſſii Etymol.* p. 779.

† Color et cæruleus, perquam ſpectabili nitore, vitrumque creditur. *Plin.* lib. xxxiv. c. 12.

‡ Verba Quadrigarii hæc ſunt: Tum Sulla conatus eſt, et tempore magno eduxit copias, ut Archelai turrim unam, quam ille interpoſuit, ligneam incenderet. Venit, acceſſit, ligna ſubdidit, ſubmovit Græcos, ignem admovit; ſatis ſunt diu conati, nunquam quiverunt incendere; ita Archelaus omnem materiam obleverat alumine. Quod Sulla atque milites mirabantur; et, poſtquam non ſuccendit, reduxit copias. *A. Gellii Noct. Att.* lib. xv. c. 1.

to

to ſet it in flames proved abortive. Many have conjectured that the ſubſtance uſed for this purpoſe was neither vitriol nor our alum, but rather aſbeſtos, which is often confounded with Atlas-vitriol *; and againſt this miſtake cautions are to be found even in Theophraſtus. But it may be aſked, With what was the aſbeſtos laid on? By what means were the threads, which are not ſoluble in water, made faſt to the wood? How could a tower be covered with it? I am rather inclined to believe, that a ſtrongly ſaturated vitriol-lye might have, in ſome meaſure, ſerved to prevent the effects of the fire, at leaſt as long as a thin coat of potter's-earth or flour-paſte, which, in the preſent age, have been thought deſerving of experiments attended with conſiderable expence. It does not however appear that the invention of Archelaus, which is ſtill retained in ſome old books †, has been often put in practice ‡;

* The *halotrichum* of Scopoli. See *Scopoli Tentamen de hydrargyro Idrienſi*, and his *Principia mineralogiæ*, p. 81. See alſo my obſervations on *Sages Chemiſche unterſuchung einiger mineralien*. p. 149. *Chartheuſer, Elementa mineral.* p. 43; and *Wallerii Syſtem. Miner.* ii. p. 32. The firſt perſon who diſcovered this ſalt to be vitriolic was Henkel, as we find in his *Kieſsbiſtorie*, p. 856, where he calls it *Atlas-vitriol.*

† Wecker de Secretis, lib. ix. 18. p. 445.

‡ I can give only one inſtance of its being uſed for this purpoſe, taken from Ammianus Marcellinus: Perſæ aggerum altitudine jam in ſublime porrecta, machinæque ingentis horrore perculſi, quam minores quoque ſequebantur, omnes exurere vi maxima nitebantur; et aſſidue malleolos atque incendiaria tela torquentes laborabant incaſſum; ea re quod humectis ſcortis et centonibus erant opertæ materiæ plures, aliæ unctæ alumine diligenter, ut ignis per eas laberetur innoxius. *Ammian. Marcel.* lib. xx. c. 12.

for writers on the art of war, ſuch for example as Æneas *, recommended vinegar to be waſhed over wood in order to prevent its being deſtroyed by fire.

I ſhall now proceed to the hiſtory of our preſent alum, which was undoubtedly firſt made in the Eaſt. The period of the invention I cannot exactly determine, but I conclude with certainty, that it is later than the twelfth century; for John, the ſon of Serapion, who lived after Rhazes, was acquainted with no other alum than the impure vitriol of Dioſcorides †. What made the new alum firſt and principally known, was its beneficial uſe in the art of dyeing, in which it is employed for fixing as well as rendering brighter and more beautiful different colours. This art, therefore, the Europeans learned from the Orientals, who, even yet, though we have begun to apply chemiſtry to the improvement of dyeing, are in ſome reſpects ſuperior to us, as is proved by the red of Adrianople, their ſilks and their Turkey-leather. The Italians procured their firſt alum from the Levant, along with other materials for dyeing; but when theſe countries were taken poſſeſſion of by the Turks, it grieved the Chriſtians to be obliged to purchaſe theſe neceſſary articles from the common

* Majus juverit, ſi prius ligna aceto linantur; nam a materia aceto illita ignis abſtinet. *Æneæ Poliorcet.* cap. 34.

† Johannis Serapionis Arabis de ſimplicibus medicinis opus; edit. Othonis Brunsfelſii, Argentorati 1531, fol. cap. 410, p. 276.

enemy,

enemy, and bitter complaints on that ſubject may be ſeen in the works of various authors. In the courſe of time, the Italians became acquainted with the art of boiling alum; for ſome of them had rented Turkiſh alum-works, and manufactured that ſalt on their own account. They, at length, found aluminous minerals in their own country, on which they made experiments. Theſe having anſwered their expectations, they were ſoon brought into uſe; and this branch of trade declined afterwards ſo much in Turkey, that many of the alum-works there were abandoned.

We are told by many hiſtorians, that the Europeans who firſt made alum in Italy learned their art, as Auguſtin Juſtinian ſays, at *Rocca di Soria*, or Rocca in Syria. Neither in books of geography or charts, however, can I find any place of this name in Syria. I at firſt conjectured that Rocca on the Euphrates might be here meant *; but at preſent it appears to me more probable that it is Edeſſa, which is ſometimes called Roha, Raha, Ruha, Orfa, and alſo Roccha, as has been expreſsly remarked by Niebuhr †. Edeſſa is indeed reckoned to be in Meſopotamia; but ſome centuries ago Syria, perhaps, was underſtood in a more ex-

* Büſchings Geograph. v. p. 214. Beſchreibung der Reyſs Leonhardi Rauwolffen. Frank. 1582. 4to. ii. p. 36. Naukeurige beſchryving van Aſie—door Dapper. Amſterdam 1680. fol. p. 23.

† Reiſebeſchreibung, ii. p. 408, 409. Dapper, p. 26. Büſching, p. 212. *See alſo* Michaelis Orientaliſche Bibliothek, xiii. p. 46.

tenſive

tenſive ſenſe. This much, at leaſt, is certain, that minerals which indicate alum, ſuch for example as bitumen, have been often obſerved by travellers in that neighbourhood *.

It appears that the new alum was at firſt diſtinguiſhed from the ancient vitriol by the denomination of *Rocca*, from which the French have made *alun de roche*, and ſome of the Germans *rotzalaun* †. Reſpecting the origin of this name very different conjectures have been formed. Some think it is derived from *rocca*, which in the Greek ſignifies a rock, becauſe this ſalt is by boiling procured from a ſtone; and theſe tranſlate the word *alumen rupeum*, from which the French name is formed ‡. Some are of opinion, that alum boiled from ſtones has been ſo called to diſtinguiſh it from that procured from ſand, which is generally combined more with iron than the former ||; and others maintain that alum acquired the name of

* Büſching, p. 200.

† This ſingular appellation occurs in *Valentini Hiſtoria ſimplicium*; in Martini's Dictionary of natural hiſtory; and ſeveral other works.

‡ Vulgo audis *alumen rochæ*, quæ Græca vox maximæ Europæ ſervit parti ad rupem ſignificandam. *Jul. Cæſ. Scaligeri Exot. exercitat.* Francof. 1612. 8vo. p. 325.

|| This is the opinion of Mazeas; a tranſlation of whoſe treatiſe I cauſed to be inſerted in the *Naturforſcher*, ii. p. 217. I ſhall here take occaſion to remark, that ſand ſeems to have been employed for making alum in the time of Agricola, as appears by his book *De ortu et cauſis ſubterraneorum*, p. 47.

Rocca

Rocca from the alum-rocks in the neighbourhood of Tolfa *. It is to be remarked on the other hand, that Biringoccio, that expert Italian, confeſſes he does not know whence the name has ariſen †. As for my part, I am inclined to adopt the opinion of Leibnitz, that *alumen roccæ* was that kind firſt procured from Rocca in Syria; and that this name was afterwards given to every good ſpecies of alum, as we at preſent call the pureſt *Roman alum* ‡.

In the fifteenth century, there were alum-works in the neighbourhood of Conſtantinople, from which Petrus di Caſtro, of whom I ſhall have occaſion to ſpeak hereafter, learned his art. May not theſe alum-works be thoſe viſited by Bellon, and of which he has given an excellent deſcription ||? He names the place *Cypſella* or *Chypſilar*, and ſays, that the alum in commerce is called *alumen Leſbium*, or *di Metelin* §. The alum procured from Conſtantinople at preſent, may perhaps be brought from the ſame ſpot; but I am not ſufficiently acquainted with its ſituation to determine

* Mercati is of this opinion, in his Metallotheca, p. 54.

† Pyrotechnia. In Venegia 1559. 4to. lib. ii. cap. 6.

‡ Cum conſtet, ejus coquendi artem vix trecentis abhinc annis a Rocca Syriæ in Europam rediiſſe (unde *aluminis Roccæ* non intellecta vulgo appellatio), atque in Italia primum exercitam, ſerius in Germaniam penetraſſe. *Leibnitii Protogæa*, p. 47.

|| Belonii Obſervationes, *in the end of* Cluſii Exotica, cap. lxi. p. 64.

§ The latter name occurs in Biringoccio, Pyrotechnia, p. 31.

that

that point with certainty, for Büſching makes no mention of it. In ſome maps I find the names *Ypſala* and *Chipſilar* on the weſtern ſide of the river Mariza, Mariſs or Maricheh, which was the Hebrus of the ancients *; in others ſtands the name *Scapſiler* on the weſt bank of the ſea Bouron †; and it is not improbable that theſe may be all derived from the old *Scapteſyle* or *Scapta Hyla*, where, according to the account of Theophraſtus, Pliny, and others, there were conſiderable mines ‡.

Another alum-work, no leſs celebrated in the fifteenth century, was eſtabliſhed near the city *Phocæa Nova*, at preſent called *Foya Nova*, not far from the mouth of the Hermus, in the neighbourhood of Smyrna ||. Of this work, Ducas, who had a houſe there, has given a particular deſcription, from which we learn that in his time, that is under the reign of Michael Palæologus, it was farmed by Italians, who ſold the produce of it to their countrymen, and to the Dutch, French, Spaniards, Engliſh, Arabs, Egyptians, and people of Syria.

* Carte de la Grèce, dreſſée ſur les mémoires de MM. Wheeler, Tournefort—par G. de l'Iſle. A Amſterdam, chez Ottens. In this chart we find expreſsly noticed: *Ypſala, Chapſilar, alum-mines*. The ſame ſituation is given to *Ipſela, Cypſela* in the map of Thrace and Greece, in Pocock's Travels.

† In Lotter's map of *Græcia nova*.

‡ Cellarii Geographia, i. p. 1299. In the map, however, publiſhed a few years ago at Berlin, under the title of *Græcia antiqua delineata a* I. C. R. A. G. *Scapta Hyla* is placed on the weſt ſide, and *Cypſela* on the eaſt.

|| Büſching's Geograph. v. p. 74.

This

This author relates very minutely, in what manner the alum was made *, but that work has been long ſince abandoned †: alum however made in the neighbourhood is ſtill exported from Smyrna ‡. It

* In Phocis, which lies cloſe to Ionia, there is a mountain abundant in aluminous mineral (ορος την εν ῳ μεταλλον συπτηριας ὑπαρχει). The ſtones found on the top of this mountain are firſt calcined in the fire, and then reduced to ſand by being thrown into water. The water mixed with that ſand is put into a kettle; and a little more water being added to it, and the whole having been made to boil, the ſand is liquefied, and the thick part which falls to the bottom in a cake is preſerved; what is hard and earthy is thrown away as of no uſe. The cake is afterwards ſuffered to diſſolve in veſſels for four days; at the end of which the alum is found in cryſtals around their edges, and the bottoms of them alſo are covered with pieces and fragments of the like nature. The remaining liquor, which at the end of four days does not coagulate or harden, is poured into a kettle, more water and more ſand is added to it; and being boiled as before, it is put into proper veſſels, and the alum obtained in this manner is preſerved as an article very neceſſary for dyers. All maſters of ſhips, bound from the Levant to Europe, conſider alum as a very convenient and uſeful lading for veſſels. - - - - In the reign of Michael Palæologus, the firſt emperor of his family, ſome Italians requeſted a leaſe of that mountain, for which they promiſed to pay a certain ſum annually. - - - - The Romans and the Latins built *Phocæa Nova* on the ſea-ſhore, at the bottom of that mountain which lies on the eaſt ſide of it. On the weſt it has the iſland of Leſbos, on the north the neighbouring bay of Elæa, and on the ſouth it looks towards the Ionian ſea. *Ducæ, Michaelis Ducæ nepotis, Hiſtoria Byzantina, res imperio Græcorum geſtas complectens a Joanne Palæologo I. ad Mehemetem II.* —— ſtudio et opera Iſmaëlis Bullialdi. Venetiis 172. 9. p. 71.

† Bullialdi in his obſervations on Ducas, p. 186.

‡ Obſervations ſur le commerce et ſur les arts, par Flachat. Lyon 1766. ii. p. 431. The alum of Smyrna is mentioned by Baumé in his Experimental Chemiſtry, i. p. 458.

is

is much to be wiſhed, that ingenious travellers would examine the alum-works in Thrace, around Smyrna, and in Turkey in general, and give an accurate deſcription of them according to the ſtate in which they are at preſent *.

The oldeſt alum-works in Europe were eſtabliſhed about the middle of the fifteenth century, but where they were firſt erected cannot with certainty be aſcertained; for it appears that ſeveral were ſet on foot in different places at the ſame period. Some affirm that the firſt alum made in Europe was manufactured in the iſland Ænaria, or Pithacuſa, at preſent called Iſchia, by a Genoeſe merchant, whom ſome name Bartholomew Perdix, and others Pernix. This man, who is praiſed on account of his ingenuity, and attachment to the ſtudy of natural hiſtory, having often travelled through Syria,

* Profeſſor Sprengel was ſo kind as to point out to me where an account might be found of other Eaſtern alum-works. This information is contained in a treatiſe of Franceſco Balducci, written in the middle of the fourteenth century, on the ſtate of commerce at that time, and printed in a book intitled *Della decima e di varie altre gravezze impoſte dal commune di Firenze*. Liſbona e Lucca 1765. 4to. 4 vol. Of Pergolotti ſome account may be ſeen in vol. ii. p. 61 and 74; and what he ſays of the kinds of alum then in uſe is in vol. iii. p. 368. I muſt acknowledge that I do not underſtand this old Italian author; and the learned marquis Hippolito Durazzo of Genoa, author of the well written *Elogio di Chriſtophoro Colombo*, when I had the pleaſure of ſeeing him lately, confeſſed that ſome parts were unintelligible even to him. It appears, however, from this work, that in the fourteenth century the Italians were acquainted with no other than Turkiſh alum.

learned the method of boiling alum at Rocca; and on his return found alum-ſtones among the ſubſtances thrown up by the eruption of a volcano which had deſtroyed part of the iſland, and gave occaſion to their being firſt employed in making that ſalt. Such is the account of reſpectable hiſtorians, Pontanus *, Bizaro †, Auguſtine Juſtinian,

* I ſhall embrace this opportunity of giving a brief account of the ſituation of the iſland, and of the nature of its ſoil. That Ænaria has been at ſome time violently ſeparated from the continent by an earthquake, ſeems proved by a variety of circumſtances, ſuch as calcined rocks; the ground full of caverns; and the earth, which, like that of the main land, being abundant in warm ſprings and dry, feeds internal fire, and on that account contains a great deal of alum. A few years ago Bartholomew Perdix, a Genoeſe merchant, paſſing this iſland, in his way to Naples, obſerved ſome aluminous rocks ſcattered here and there along the ſea coaſt. About an hundred and ſixty-three years before that period, the earth having ſuddenly burſt by the effects of fire confined in its bowels, a conſiderable part of Ænaria was involved in flames. By this eruption a ſmall town was burned and afterwards ſwallowed up; and large maſſes of rock mixed with flames, ſand and ſmoke thrown up, where the ſhore looks towards Cumæ, fell upon the neighbouring fields, and deſtroyed the moſt fruitful and the moſt pleaſant part of the iſland. Some of theſe huge pieces of rock being at that time ſtill lying on the ſhore, Bartholomew, by calcining them in a furnace, extracted alum from them, and revived that art which he had brought from Rocca in Syria, where he had traded for ſeveral years, and which had been neglected in Italy for many centuries. *Joannis Joviani Pontani Hiſtoriæ Neapolitanæ libri ſex*, in *Græevii Theſaurus antiquit. et hiſtoriarum Italiæ*, vol. ix. part 3. p. 88.

† I muſt not omit to mention that about this time Bartholomew Pernix, a citizen and merchant of Genoa, who had reſided long in Syria for the purpoſe of commerce, returned to his native country. Soon after he made a voyage to the iſland of Ænaria, ſituated in the Tuſcan ſea, called

an *, and Bottone †, who wrote much later. Bizaro ſays, that this happened in the year 1459, which agrees perfectly with the account of Pontanus; for he tells us that it was under the reign of Ferdinand I, natural ſon of Alphonſus, who mounted the throne in 1458. Beſides, the earthquake, which had laid waſte the iſland one hundred and ſixty-three years before, took place in 1301, which

called formerly Pythacuſa, and now in the vulgar Greek Iſcla or Iſchia; and being a man of an acute genius, and a diligent inveſtigator of natural objects, he obſerved near the ſea coaſt ſeveral rocks fit for making alum. He took ſome fragments of them therefore, and, having calcined them in a furnace, he procured from them moſt excellent alum. He was the firſt perſon who, to the incredible benefit of many, brought as it were again into uſe that art long abandoned and almoſt loſt in Italy and the greater part of other countries. On that account his name deſerves to be reſcued from oblivion. *Senatus populique Genuenſis rerum hiſt. atque annal. auctore Petro Bizaro Sentinati.* Antverpiæ 1579. fol. p. 302.

* About that period (1459) Bartholomew Pernix, a Genoeſe merchant, ſailing paſt the iſland of Enaria or Iſchia, learned that there were near the ſhore many aluminous rocks, that is to ſay, fit for making alum. He took ſome of them, therefore, and having cauſed them to be calcined in a furnace, he procured from them moſt excellent alum. This Bartholomew brought back to Italy from the city of Rocca, in Syria, where he had traded many years, the art of making alum, which had been neglected and loſt for a long ſpace of time. *Caſtigatiſſimi annali, con la loro copioſa tavola, della republica di Genoa, da fideli e approvati ſcrittori, per Monſignore Agoſtino Giuſtiniano, Genoeſe, Veſcovo di Nebio.* Genoa 1537. fol. lib. v. p. 214.

† Dominici Bottone, Pyrologia topographica; id eſt, de igne diſſertatio. Neapoli 1692. 4to. p. 313. This author calls the inventor *Perdix*, and not *Pernix*.

makes

makes the time of this invention to fall about the year 1464. So ſeems Bottone alſo to have reckoned, for he mentions expreſsly the year 1465.

The alum-work which is ſituated about an Italian mile north-weſt from Tolfa, and ſix from Civita Vecchia, in the territories of the Church, is by ſome Italian hiſtorians reckoned to have been the firſt. However this may be, it is certain that it is the oldeſt carried on at preſent. The founder of it was John di Caſtro, a ſon of the celebrated lawyer, Paul di Caſtro *, who had an opportunity at Conſtantinople, where he traded in Italian cloths, and ſold dye-ſtuffs, of making himſelf acquainted with the method of boiling alum. He was there at the time when the city fell into the hands of the Turks; and after this unfortunate event, by which he loſt all his property, he returned to his own country. Purſuing there his reſearches in natural hiſtory, he found in the neighbourhood of Tolfa a plant which he had obſerved growing in great abundance in the aluminous diſtricts of Aſia: from this he conjectured, that the earth of his native ſoil might alſo contain the ſame ſalt; and he

* The moſt authentic account of Paul di Caſtro is to be found in *Fabricii Biblioth. lat. mediæ et infimæ ætatis*, vol. v. p. 617, and in *Joh. Fichardi Vitæ Iſtorum*, which is printed along with *Pancirolli Libri de claris legum interpretibus*. Lipſiæ 1721. 4to. p. 186. Paul di Caſtro was not of Caſtro in the kingdom of Naples, as is ſaid in Jocher's *Gelehrten Lexicon*, but of Caſtro belonging to the duchy of the ſame name in the Eccleſiaſtical States.

was confirmed in that opinion by its aſtringent taſte. At this time he held an important office in the Apoſtolic Chamber; and this diſcovery, which ſeemed to promiſe the greateſt advantages, was conſidered as a real victory gained over the Turks, from whom the Italians had hitherto been obliged to purchaſe all their alum. Pope Pius II, who was too good a financier to neglect ſuch a beneficial diſcovery, cauſed experiments to be firſt made at Viterbo, by ſome Genoeſe who had formerly been employed in the alum-works in the Levant, and the ſucceſs of them was equal to his expectations. The alum, which was afterwards manufactured in large quantities, was ſold to the Venetians, the Florentines and the Genoeſe. The Pope himſelf has left us a very minute hiſtory of this diſcovery, and of the circumſtances which gave riſe to it *.

Some

* A little before that period came to Rome John di Caſtro, with whom the Pontiff had been acquainted when he carried on trade at Baſle, and was banker to Pope Eugenius. His father, Paul, was a celebrated lawyer of his time, who ſat many years in the chair at Padua, and filled all Italy with his deciſions; for law-ſuits were frequently referred to him, and judges paid great reſpect to his authority, as he was a man of integrity and ſound learning. At his death he left conſiderable riches, and two ſons arrived to the age of manhood, the elder of whom, following the profeſſion of the father, acquired a very extenſive knowledge of law. The other, who was a man of genius, and who applied more to ſtudy, made himſelf acquainted with grammar and hiſtory; but, being fond of travelling, he reſided ſome time at Conſtantinople, and acquired much wealth by dyeing cloth made in Italy, which was tranſported thither, and committed to his care, on account of the abundance of alum in that neighbourhood. Having by theſe means

Some pretend that Caſtro was ſeveral years a ſlave to a Turk who traded in alum *; others affirm, that

means an opportunity of ſeeing daily the manner in which alum was made, and from what ſtones or earth it was extracted, he ſoon learned the art. When, by the will of God, that city was taken and plundered about the year 1455, by Mahomet II, emperor of the Turks, he loſt his whole property; but, happy to have eſcaped the fire and ſword of

* The Frangipani a third time acquired lands in the kingdom of Naples. When they poſſeſſed in Maremma di Roma, Tolfa, Caſtello, and a juriſdiction which brings at preſent eighty thouſand crowns annually to the Church, it happened that a ſon of Paul di Caſtro, a celebrated doctor, and a vaſſal of theſe lords, who had been many years a ſlave in Turkey to an alum-merchant, returned free to his own country; and obſerving that in the territories of Tolfa there was abundance of alum mineral, he gave notice of it to Lodovico Frangipani, his lord, and was the cauſe of greatly increaſing his revenues. Pope Paul II, however, pretending that the mineral belonged to the Apoſtolic See, as ſupreme lord of the fief; and not being able to perſuade Lodovico to give it up to the Church, he declared war againſt him; but was vigorouſly oppoſed by Lodovico and his brother Peter, lords of Tolfa, aſſiſted by the Orſini their relations, ſo that the Pope was obliged to bring about an accommodation with them by means of king Ferrante I, and to pay them as the price of Tolfa ſixteen thouſand crowns of gold, of which Lodovico gave twelve thouſand to the king, and was inveſted by him in the lordſhip of Serino in the year 1469 ——— *Diſcorſi delle famiglie eſtinte, foreſtiere, o non compreſe ne' Seggi di Napoli, imparentate colla caſa della Marra. Compoſti dall Signor Don Ferrante della Marra, duca della Guardia; dati in luce da Don Camillo Tutini Napolitano.* In Napoli 1641. fol. p. 178.

See alſo Iſtoria dell' antichiſſima città de Civita Vecchia, ſcritta dal Marcheſe Antigono Frangipani. In Roma 1761. 4to. p. 119, 120, 121. 128. Platina, in his Life of Pope Pius II, ſays nothing further of this remarkable circumſtance than: Fodinas invenit (Pius II), tum primum aluminis apud Tolfam inſtituit.

that he had even been obliged to labour as a ſlave in alum works *; and others, that he learned the art

of theſe cruel people, he returned to Italy, after the aſſumption of Pius II. to whom he was related, and from whom he obtained, as an indemnification for his loſſes, the office of commiſſary-general over all the revenues of the Apoſtolic Chamber, both within and without the city. While, in this ſituation, he was traverſing all the hills and mountains, ſearching the bowels of the earth, leaving no ſtone or clod unexplored, he at length found ſome alum-ſtone in the neighbourhood of Tolfa. Old Tolfa is a town belonging to two brothers, ſubjects of the Church of Rome, and ſituated at a ſmall diſtance from Civita Vecchia. Here there are high mountains, retiring inland from the ſea, which abound with wood and water. While Caſtro was examining theſe, he obſerved that the graſs had a new appearance. Being ſtruck with wonder, and inquiring into the cauſe, he found that the mountains of Aſia, which enrich the Turkiſh treaſury by their alum, were covered with graſs of the like kind. Perceiving ſeveral white ſtones, which ſeemed to be minerals, he bit ſome of them, and found that they had a ſaltiſh taſte. This induced him to make ſome experiments by calcining them, and he at length obtained alum. He repaired, therefore, to the Pontiff, and addreſſing him ſaid, "I announce "to you a victory over the Turk. He draws yearly from the Chriſ- "tians above three hundred thouſand pieces of gold, paid to him for "the alum with which we dye wool different colours, becauſe none is "found here but a little at the iſland of Hiſcla, formerly called Æna- "ria, near Puteoli, and in the cave of Vulcan at Lipari, which, being "formerly exhauſted by the Romans, is now almoſt deſtitute of that "ſubſtance. I have, however, found ſeven hills, ſo abundant in it, "that they would be almoſt ſufficient to ſupply ſeven worlds. If you "will ſend for workmen, and cauſe furnaces to be conſtructed, and "the ſtones to be calcined, you may furniſh alum to all Europe; and "that gain which the Turk uſed to acquire by this article, being "thrown into your hands, will be to him a double loſs. Wood and "water are both plenty, and you have in the neighbourhood the port of "Civita

* Ferbers Briefe über Welſchland, p. 246.

art of boiling alum from a citizen of Corneto, a town in the dominions of the Pope, and from a Genoeſe,

"Civita Vecchia, where veſſels bound to the weſt may be loaded. "You can now make war againſt the Turk: this mineral will ſupply "you with the ſinews of war, that is money, and, at the ſame time, "deprive the Turk of them." Theſe words of Caſtro appeared to the Pontiff the ravings of a madman: he conſidered them as mere dreams, like the predictions of aſtrologers; and all the cardinals were of the ſame opinion. Caſtro, however, though his propoſals were often rejected, did not abandon his project, but applied to his holineſs by various perſons, in order that experiments might be made in his preſence, on the ſtones which he had diſcovered. The Pontiff employed ſkilful people, who proved that they really contained alum; but leſt ſome deception might have been practiſed, others were ſent to the place where they had been found, who met with abundance of the like kind. Artiſts who had been employed in the Turkiſh mines in Aſia were brought from Genoa; and theſe, having cloſely examined the nature of the place, declared it to be ſimilar to that of the Aſiatic mountains which produce alum; and, ſhedding tears for joy, they kneeled down three times, worſhipping God, and praiſing his kindneſs in conferring ſo valuable a gift on our age. The ſtones were calcined, and produced alum more beautiful than that of Aſia, and ſuperior in quality. Some of it was ſent to Venice and to Florence, and, being tried, was found to anſwer beyond expectation. The Genoeſe firſt purchaſed a quantity of it, to the amount of twenty thouſand pieces of gold; and Coſmo of Medici for this article laid out afterwards ſeventy-five thouſand. On account of this ſervice, Pius thought Caſtro worthy of the higheſt honours, and of a ſtatue, which was erected to him in his own country, with this inſcription: "To John di Caſtro, the inventor of alum;" and he received beſides a certain ſhare of the profit. Immunities and a ſhare alſo of the gain were granted to the two brothers, lords of Tolfa, in whoſe land the aluminous mineral had been found. This acceſſion of wealth to the Church of Rome was made, by the divine bleſſing, under the pontificate of Pius II; and if it eſcape, as it ought, the hands of tyrants, and be prudently managed, it may increaſe, and afford no ſmall aſſiſtance to the Roman Pontiffs in ſupporting the burdens of the Chriſtian religion.—— *Pii Secundi Comment. rer. memo-*

Genoeſe, both of whom had acquired their knowledge in the Levant*. But as I do not wiſh to aſcribe a falſehood to the Pontiff, I am of opinion that the hiſtory of this diſcovery muſt have been beſt known to him. He has not, indeed, eſtabliſhed the year with ſufficient correctneſs; but we may conclude from his relation that it muſt have been 1460 or 1465. The former is the year given by Felician Buſſi; and the latter that given in the hiſtory of the city of Civita Vecchia.

The plant which firſt induced John di Caſtro to ſearch for alum was that ever-green, prickly ſhrub, the *ilex aquifolium*, or holly, which in Italy is ſtill

rab. quæ temp. ſuis contigerunt, Joan. Gobellino compoſiti, a Franc. Bandino Picolomineo ex vetuſto origin. recog.; quibus hac edit. accedunt Jac. Picolominei Rer. geſt. ſui temp. commentarii. Francofurti 1614. fol. p. 185.

* This year (1460) is diſtinguiſhed by the diſcovery of alum at Tolfa Vecchia, no one there having been acquainted with it till that period: and this happened by means of one John di Caſtro, who had acquired ſome knowledge of it from a young man of Corneto, and a Genoeſe, who had learned in Turkey the whole proceſs of making it. The ſaid John having obſerved that in the mountains of Tolfa there were undoubtedly veins of alum, he cauſed ſome of the earth and ſtones to be dug up, and the firſt experiments were made on them at Viterbo in the following manner. The ſtones were firſt calcined in a furnace; a large quantity of water was then thrown over them; and when they were entirely diſſolved, the water was boiled in great leaden cauldrons; after which it was poured into wooden veſſels; where evaporating by degrees, the reſult was alum of the moſt perfect kind. Pope Pius II, ſenſible of the great benefit which might ariſe from this mineral to the Apoſtolic Chamber, employed more than eight hundred perſons at Tolfa in preparing it.——*Hiſtoria della città de Viterbo, di Feliciano Buſſi.* In Roma 1742. fol. p. 262.

conſidered as an indication that the regions where it grows abound with that ſalt *. But though it is undoubtedly certain that the quality of the ſoil may be often diſcovered by the wild plants which it produces, it is alſo true that this ſhrub is frequently found where there is not the ſmalleſt trace of alum; and that it is not to be ſeen where the ſoil abounds with it, as has been already remarked by Boccone † and Tozzetti ‡.

Among the earlieſt alum-works may be reckoned that which was erected at Volterra, in the diſtrict of Piſa, in 1458, by a Genoeſe named Antonius §. Others ſay that it was conſtructed by an architect of Sienna ‖; but this opinion has, perhaps, ariſen

* Labats Reiſen nach Welſchland. Frankf. and Leipzig. vol. v. 1760. 8vo. p. 3 et ſeq.

† Muſeo di fiſica e di eſperienze, di Don Paolo Boccone. In Venetia 1697. p. 152.

‡ Targioni Tozzetti, Viaggi, vii. p. 234.

§ Anno 1458. Rock alum, which the Greeks call *pharno*, was at this time firſt diſcovered by a Genoeſe in the territories of Volterra, where being boiled and found to be good, it began to be dug up afterwards in many of the mountains of Italy. Till that period the Italians had made no uſe of mines of this kind; for our alum was all brought from Turkey. The above diſcovery was, therefore, a great advantage to to us.——*Supplementum ſupplementi chronicorum; edit. et caſt. a patre Jacobo Philippo Bergomare.* Venetiis 1513. fol. p. 299.

‖ Antonius quidam Senenſis architectus, haud longe ab ea urbe (Berignone, jam diu deleta), ad eum proſpectum qui vergit ad Cecinæ fluvium, aluminis tolpham (*probably* mineram) comperuit, in publico uſu atque in vectigalium cenſu neutiquam ſpernendam.——*Giovanni Giovannienſe, Monarchia Medicea*, p. 51, 58.

only from the work having been farmed by a citizen of Sienna, or built at his expence. On account of this alum-work an insurrection of the inhabitants of Volterra broke out in 1472; but it was at length quelled by the Florentines, who took and plundered the city *. Brutus †, who wrote his History of Florence in the year 1572, says that alum-work was carried on in his time: but this is certainly false; for Raphael di Volterra ‡, who died in 1521 in his native city, expressly tells us, that, in his time, alum was no longer boiled there; and this is confirmed by Baccius §, who also lived in the sixteenth century. At present, no remains of it are left; so that Tozzetti was not able to discover the place where the alum-stones were broken ‖.

It appears from what has been said, that the art of boiling alum in Europe was first known in Italy, but not before the year 1458. That document,

* An account of this dispute between the Florentines and the people of Volterra may be seen in Machiavel's History of Florence, book vii. TRANS.

† Jo. Michaël. Bruti Historia Florentina. Venetiis 1764. 4to. lib. v. p. 244.

‡ Nunc foditur alumen nuper inventum pluribus in locis in Hetruria, apud Forum Claudii, præterea in agro Mussano et Volaterrano; sed Volaterranum jam desiit.—*Raphaelis Volaterrani Comment. urbani.* Francof. 1603. fol. p. 1020.

§ De Thermis.

‖ Relazioni d'alcuni viaggi fatti in diverse parti della Toscana. In Firenze, tom. iii. p. 117.

therefore,

therefore, of the year 1284, quoted by Tozzetti, and in which alum-works, *alumifodinæ*, are mentioned, muſt, as he himſelf thinks, be undoubtedly falſe *.

The great revenue which the Apoſtolical Chamber derived from alum, induced many to ſearch for aluminous minerals, and works were erected wherever they were found. Several manufactories of this ſubſtance were eſtabliſhed, therefore, in various parts, which are mentioned by Baccius †, Biringoccio, and other writers of the ſixteenth century. The Pope, however, underſtood his own intereſt ſo well, that he never reſted until he had cauſed all the works erected in the territories of others to be given up, and until he alone remained maſter of the prize. He then endeavoured, by every method poſſible, to prevent foreigners from acquiring an accurate knowledge of the art of boiling alum; and at the ſame time found means, by entering into commercial treaties with other nations, and by employing the medium of religion, which has always the greateſt effect on weak minds, to extend his commerce in this article more and more. The price was raiſed from time to time,

* The words of the document are: Vendo montem rotundum cum balneis—et cum aurifodinis, argentifodinis, erifodinis. cretifodinis, ſufodinis, et alumifodinis et aluminibus ceteribus (*perhaps* veteribus). *Tozzetti, Viaggi*, vii. p. 51.

† Andreas Baccius de thermis. Venetiis 1588. fol. p. 293. Tozzetti, iv. p. 186.

and it at length became ſo high that foreigners could purchaſe this ſalt at a cheaper rate from the Spaniards, and even when they ſent for it to Turkey. His holineſs, that he might convert this freedom of trade into a ſin, and prevent it by the terror of excommunication, artfully gave out that he meant to ſet apart the income ariſing from his alum-works to the defence of chriſtianity; that is, towards carrying on war againſt the Turks. Prohibitions and threats now followed in caſe any one ſhould be ſo unchriſtian as to purchaſe alum from the Infidels; but every perſon was at liberty to make what bargain he could with his holineſs for this commodity.

In the year 1468, Pope Paul II entered into a commercial treaty reſpecting alum with Charles the Bold, duke of Burgundy; but, in 1504, Roman alum had riſen to ſuch an exorbitant price, that Philip the Fair, archduke of Auſtria, cauſed a council of enquiry to be held at Bruges, by which it appeared that this article could be purchaſed at a much cheaper rate in Turkey. Commiſſions, therefore, were ſent thither for that purpoſe*; but ſcarcely was this known at Rome, when a prohibition, under pain of excommunication, was iſſued by Pope Julius II. This pontiff, however, was not the only one from whom ſuch prohibitions proceeded: bulls of the like kind were iſſued alſo

* Les anciens minéralogiſtes, par Gobet, vol. ii. p. 805.

by

by Julius III, Paul III, Paul IV, Gregory XIII, and others *.

But theſe means, like all thoſe founded on the ſimplicity of others, could not be of long duration; and as ſoon as men became a little more enlightened, they learned to know their own intereſt, and to diſcover the ſelfiſhneſs of the Pope's bulls. Un-

* Cum Pontifex Pius II hujuſmodi inventi aluminis in Tuſcia redditus et proventus in fidei defenſionem dedicaſſet et conſecraſſet, meritoque Julius II vetuerit alumina ex Infidelium terris adduci, et Chriſtianos ea mercari, ut ita ſolum venderetur et emeretur inter Chriſtianos quod in terris Romanæ Eccleſiæ inſperato fuerat adinventum, ut conſtat ex Leon. X *bulla* 36 et Pauli III. n. 48; ideo Julius III, imitatus dictum Julium II, qui primus hoc prohibuit ſub excommunicatione, et Paul. III, qui eam renovavit, *in alia ſua conſtit.* 42. in *Bullario veteri* edita anno 1553, quæ incipit: *Etſi ea*; cujus contextum adducit Scortia in *Conſtit. pontif.* epiſt. 66. theor. 173, ubi explicat ipſe Julius III renovat atque confirmat, contra facientes et complices vectores, ementes, vendentes, laborantes, ſeſe in his immiſcentes, naves et alumina aſſecurantes, Julii II et Pauli III excommunicationem; et, aggravando pœnas, eoſdem reddit inteſtabiles et incapaces hæreditatum, officiorum publicorum; eiſque omnes actus legitimos interdicit, et oppida ac civitates, ad quas declinaverint, niſi inde eos expellant intra diem unum poſt habitam de his notitiam, ſupponit interdicto eccleſiaſtico, ut Leo X *bulla* 12, et alii in rebus gravibus fecerant; et reſervat tam abſolutionem illius quam relaxationem hujus excommunicationis Pontifici Romano; et hanc eandem conſtitutionem confirmaſſe poſtea Paulum IV in *bulla* 43, quæ incipit: *Ex Apoſtolica*, et Greg. XIII, *num.* 21, quæ incipit: *Muneris*, quarum bullarum ratio ex *textu noſtro* colligitur *in verſ.* ibi: *Dummodo in mercibus ſuis* (vel alio modo) *aliquod commodum vel ſubſidium proveniret*; ut revera contingeret ſi Chriſtiani emerent alumen a Turcis, pro illo pecunias argenteas et aureas darent, quibus ditiores et potentiores fierent ad Chriſtianos debellandos, et ex verbis *d. c. olim.* 12 hic. *Nicol. Rodrig. Fermoſini Tractatus criminalium.* Lugd. 1670. 2 vol. fol. tom. ii. p. 63.

leſs

leſs Biringoccio, who viſited a part of the German mines, be under a miſtake, the firſt European alum-work without Italy was erected in Spain; and is that ſtill carried on, with conſiderable profit, at Almacaron, not far from Carthagena *. In the beginning of the ſixteenth century very large quantities of alum were brought to Antwerp, as we learn from Guicciardini's Deſcription of the Netherlands.

At what time the firſt alum-work was erected in Germany, I am not able to determine; but it appears that alum began to be made at Oberkaufungen, in Heſſe †, in the year 1554. For the alum-work at Commotau in Bohemia ‡, the firſt letters-patent were granted in 1558. An alum-work was eſtabliſhed at Lower Langenau, in the county of Glatz, in 1563; but it was ſoon after abandoned §. Several more manufactories of alum are mentioned by Agricola, ſuch as that of Dieben or Duben, in the circle of Leipſic, and thoſe of Dippoldiſwalda, Lobenſtein, &c. ‖

In England, the firſt alum-work was erected at Giſborough in Yorkſhire, in the reign of queen

* Pyrotechn. p. 31. He ſays expreſsly, that this was the only alum-work in Europe in his time without the boundaries of Italy.

† Winkelmans Beſchreibung von Heſſen, i. p. 39.

‡ Peithners Verſuch über die geſchichte der Böhmiſchen und Mähriſchen bergwerke. Wien 780. fol. p. 58.

§ Büſchings Geographie, iv. p. 843.

‖ De natura foſſilium, lib. xii.

Elizabeth;

Elizabeth; though Anderſon* ſays in 1608. Sir Thomas Chaloner, who had an eſtate there, conjecturing from the nature of the plants which grew wild, that there muſt be minerals in the neighbourhood, after making ſome ſearch, at length diſcovered alum. As there was, however, no one in England at that time who underſtood the method of preparing it, he privately engaged workmen belonging to the Pope's alum-works; and it is ſaid, that as ſoon as the Pontiff heard this, he endeavoured to recall them by threats and anathemas. Theſe, however, did no injury to the heretics; and in a little time the alum-work ſucceeded ſo well, that ſeveral more of the ſame kind were ſoon after eſtabliſhed †. But what more diſhonoured the

* Hiſtory of Commerce, iv. p. 406. "The manufacture of alum," ſays he, "was firſt found out in England, and carried on with ſucceſs in 1608. It was ſupported and patroniſed in the county of York by lord Sheffield, ſir John Bourcher, and other landholders of the ſaid county, to the great benefit of England in general, and of the proprietors in particular, to the preſent day. King James was a great promoter of this alum-work, after he had, by the advice of his miniſter, appropriated to himſelf a monopoly of it, and forbidden the importation of foreign alum.

† Such is the account of Pennant, in his *Tour in Scotland*, 1768, third edition, Warrington 774, 4to. p. 23. "The alum-works in this country are of ſome antiquity; they were firſt diſcovered by *ſir Thomas Chaloner*, in the reign of queen Elizabeth, who obſerving the trees tinged with an unuſual colour, made him ſuſpicious of its being owing to ſome mineral in the neighbourhood. He found out that the ſtrata abounded with an aluminous ſalt. At that time the Engliſh being ſtrangers to the method of managing it, there is a tradition that

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the Pontiff's denunciations was, that, in later times, the proprietors of the Engliſh alum-works farmed thoſe of the Apoſtolic Chamber, and increaſed, in various ways, the benefit derived from them *.

At what period alum-works were eſtabliſhed in other countries I have not been able to learn. I however know that one was erected at Andrarum †.

ſir Thomas was obliged to ſeduce ſome workmen from the Pope's alum-works near Rome, then the greateſt in Europe. If one may judge from the curſe which his holineſs thundered out againſt ſir Thomas and the fugitives, he certainly was not a little enraged; for he curſed by the very form that Ernulphus has left us, and not varied a tittle from that moſt comprehenſive of imprecations. The firſt pits were near *Giſborough*, the ſeat of the *Chaloners*, who ſtill flouriſh there notwithſtanding his holineſs's anathema." See alſo *A Political Survey of Britain by John Campbell*, London 1774. 2 vol. 4to. i. p. 75, and ii. p. 20. The following paſſage, extracted from *Britannia, or a Chorographical deſcription of Great Britain, by W. Camden; the third edition, by E. Gibſon*, London 1753. 2 vol. fol. vol. ii. p. 910, is much to the ſame purpoſe: "This (alum) was firſt diſcovered a few years ſince (anno 1607) by the admirable ſagacity of that learned naturaliſt ſir Thomas Chaloner, knt. (to whoſe tuition his majeſty [king James the firſt] committed the delight and glory of Britain, his ſon prince Henry), by obſerving that the leaves of trees were of a more weak ſort of green here than in other places, &c."

* Taubes Abſchilderung der Engliſchen handlung. Wien 1777. 8vo. i. p. 86. "For ſome time paſt the marquis of Lepri has farmed the alum-works at Civita Vecchia for 37,000 ſcudi. The Apoſtolical Chamber ſupplies the neceſſary wood, which the marquis muſt be at the expence of cutting down and tranſporting. About two hundred men are employed in the works; and alum to the amount of from forty-five to fifty thouſand ſcudi is ſold annually, particularly to the Engliſh and the French." See *Obſervations faites pendant un voyage en Italie, par le Baron de R. (Rieſch)*. Dreſden 1781. 2 vol. 8vo.

† Voyages metallurgiques, par M. Jars. Paris 1781. 4to. vol. iii. p. 297.

in

in Sweden, in 1630. Roman alum coſts at preſent in Holland from 40 to 48 ſchillings per cent; that of Liege from 25 to 30; that of Smyrna from 36 to 40; and Engliſh, Daniſh, and Swediſh alum from 30 to 35.

FALCONRY.

THE queſtion whether Falconry was known to the ancient Greeks, has been determined in the negative by Flavius Blondus*, Laurentius Valla,

* This author, Blondus or Biondo, deſcribing an Italian village, ſays, "I ſhall embrace this opportunity of mentioning a new circumſtance, which is, that fowling with that rapacious bird the falcon, a diverſion much followed at Arno, by the celebrated Alphonſus king of Arragon, was entirely unknown about two hundred years ago; for though Servius, the grammarian, ſays that Capua received that name from the augury of a falcon, becauſe the Hetruſcans, when founding it, ſaw one of theſe birds, which in their language was called *capis*; yet he does not tell us of what uſe they were to mankind. Beſides, Pliny, who gives the names of many rapacious birds of the hawk kind (*accipitres ſcilicet majores et minores achilvones, quos aliqui falcones fuiſſe volunt*), ſays nothing of their being employed to catch game; and, without doubt, had fowling in this manner been practiſed in the time of Virgil, he would have made Æneas and Dido carry ſuch birds along with them when they went out a-hunting, whereas he ſays only:

"Maſſyliique ruunt equites et odora canum vis.

"I will venture, therefore, to affirm, that two hundred years ago, as I have already ſaid, no nation or people were accuſtomed to catch either land or water-fowls with any rapacious bird tamed for that purpoſe."

la *, both writers of the fifteenth century; and likewiſe by Rigault †, Pancirollus, Salmuth, and many others. It may, nevertheleſs, be here aſked, what is generally underſtood under that term? However much the thouſand barks which the Grecians carried with them to the ſiege of Troy might have been inferior to thoſe floating caſtles which my countrymen ſaw lately before Gibraltar, they were nevertheleſs ſhips; and we cannot, on that account, deny that the Greeks were acquainted with the art of ſhip-building, though it was evidently then in its infancy. In the like manner, I agree with Gyraldus ‡, in allowing that they had ſome knowledge of falconry. I do not believe that they knew the art of hawking, that is, of chaſing game with birds of prey previouſly trained, as practiſed in modern times, and which ſerves more for the

"purpoſe." I ſhall here obſerve, that Biondo muſt have had a faulty copy of Pliny; for the word *achilvones* is not to be found in that author, who, nevertheleſs, mentions the practice of fowling with birds of prey.

* Valla, the moſt learned man of the century in which he lived, contradicts Antonius Renaudenſis, who ſays: *Nola* is a hawk's bell. "If *Nola*," ſays Valla, "be an old word, it cannot ſignify that bell "now worn by hawks, becauſe the ancients never tamed theſe birds for "catching game, as we do, nor ornamented them with bells. If it be a "new word, let him produce the author from whom it is taken."—— *Laurentii Vallæ Opera.* Baſiliæ 1543. fol. p. 433.

† In the preface to *Scriptores rei accipitrariæ.*

‡ Lilii Greg. Gyraldi Dialogiſmus vi, in his works printed at Leyden 1696. fol. tom. ii. p. 870. Theſe *dialogiſmi* may be found alſo in Gruter's *Theſaurus criticus*, vol. ii. p. 397.

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amuſement of trifling princes than for any uſeful purpoſe; but that they had begun to employ the rapacity of ſome of the winged tribe in hunting and fowling, cannot, in my opinion, be denied *.

So early as the time of Cteſias, hares and foxes were hunted in India, by means of rapacious birds †. The account of Ariſtotle, however, is ſtill more to the purpoſe, and more worthy of notice ‡. "In Thrace," ſays he, "the men go out "to catch birds with hawks §. The men beat the "reeds

Thoſe who are deſirous of being acquainted with the art of falconry, as practiſed at preſent, may conſult *Krunitz, Eucyclopedie*, xii. p. 137; *Spectacle de la nature*, vol. i.; or *C. W. J. Gatterer vom nutzen und ſchaden der thiere*, ii. p. 32. Alſo the article *Fauconnerie*, in the French Encyclopédie.

† Λαγωους δε και αλωπεκας θηρευουσιν, ου τοις κυσιν, αλλα κοραξι και ικτισι και κορωναις και αετοις. Cteſiæ Indica; Herodot. Hiſtor. Francof. 1608. fol. p. 660.

‡ In this part of Thrace, called formerly Cedropolis, the men go out into the marſhes in queſt of birds, accompanied by falcons. The men beat the trees and buſhes with poles, and put the birds to flight; the hawks fly after them, by which means they are ſo frightened that they fall to the ground, where the men ſtrike them with their poles, and kill them.——*Hiſtor. animal.* lib. ix. c. 6, edit. Scaligeri.

§ The Grecian authors above quoted call the rapacious birds uſed for purſuing game ιερακες; and Pliny calls them *accipitres*. It would be difficult, perhaps impoſſible, to diſtinguiſh with ſufficient accuracy all the ſpecies of theſe birds to which the ancients gave different names. This genus is numerous, and the ſpecies often differ ſo little from each other, that it is not eaſy to eſtabliſh their characteriſing marks. Beſides, they for the moſt part change their colour, and often their whole appearance, according to their age or the ſeaſon of the year; ſo that theſe marks become very uncertain. It appears that on this account the

" reeds and buſhes which grow in marſhy places, in " order to raiſe the ſmall birds, which the hawks " purſue and drive to the ground, where the fowlers " kill them with poles." The ſame account is to be found in another book aſcribed alſo to Ariſtotle; and which appears, at any rate, to be the work of an author not much younger *. In this paſſage, there are two additions, which render the circumſtance ſtill more remarkable. The firſt is, that the falcons appeared when called by their names; and the ſecond, that of their own accord they brought to the fowlers whatever they caught themſelves. Nothing is here wanting but the ſpaniel employed to find out game, the hood which

ancients of one ſpecies often formed two or more, and imagined that many ſpecies paſſed into another, or that new ſpecies were produced by the mixture of different breeds. It ſeems, however, certain that the ancients divided thoſe birds of prey which fly abroad in the day-time, into three ſpecies: αιετος aquila; γυψ vultur; and ιεραξ accipiter. The firſt and laſt belong to that genus which Linnæus calls *falco*, and are the large ſpecies of it. The vultures are the geir-falcons, which are ſufficiently diſtinguiſhed by their bald head and neck.

* Reſpecting Thrace which is ſituated above Amphipolis, a wonderful thing is told, which might appear incredible to thoſe who had never heard it before. It is ſaid that boys go out into the fields, and purſue birds by the aſſiſtance of hawks. When they have found a place convenient for their purpoſe, they call the hawks by their names, which immediately appear as ſoon as they hear their voices, and chaſe the birds into the buſhes, where the boys knock them down with ſticks and ſeize them. What is ſtill more wonderful, when theſe hawks lay hold of any birds themſelves, they throw them to the fowlers; but the boys, in return, give them ſome ſhare of the prey. *De mirabilibus auſcultat.* cap. 128.

is

is put upon the head of the hawk while it ſtands on the hand, and the thong uſed for holding it, to form a ſhort deſcription of falconry as ſtill practiſed. Our falconers, when they have taken the bird from the hawk, give him, in return, a ſmall ſhare of it; and in the like manner the Thracian hawks received ſome part of their booty. Other writers after Ariſtotle, ſuch as Antigonus *, Ælian †, Pliny ‡, and Phile §, have alſo given an account

* Antigoni Caryſtii Hiſtoriæ mirabiles, cap. 34.

† Hawks, which are no leſs fit for fowling than eagles, and which are not inferior to them in ſize, are of all birds reckoned to be the tameſt, and the fondeſt of man. I have heard, that in Thrace they accompany people when they go out in queſt of birds in the fens. The fowlers, having ſpread their nets, remain quiet, while the hawks flying about terrify the birds, and drive them into them. When the Thracians catch any birds, they divide them with the hawks, by which means they render them faithful partners in fowling: if they did not give them a ſhare of the booty, they would be deprived of their aſſiſtance.——*Hiſtor. anim.* lib. ii. cap. 42.

‡ Lib. x. c. 8. In a part of Thrace above Amphipolis, men and hawks go out a-fowling, as it were in company. The former drive the birds from among the buſhes and reeds, and the latter flying after them ſtrike them down. The fowlers divide with them their prey.—The remaining lines of this paſſage, *Traditum eſt, miſſas in ſublime ſibi excipere eos: et cum tempus ſit capturæ, clangore et volatus genere invitare ad occaſionem*, ſeem to be miſplaced or mutilated, as has been already remarked by Conrad Geſner. See his *Hiſtor. nat.* lib. iii. p. 15.

§ Phile de animal. proprietate, according to Berſmann's tranſlation, p. 36.

Poſt multinodas quam plagas venatibus
Thraces tetenderunt, latent abſconditi;
Quos advolantes cominus circi juvant,
Metuque territant volucres belluas,

account of this method of fowling. Ælian, who ſeldom relates any thing without ſome alteration or addition, ſays, that in Thrace nets were uſed, into which the birds were driven by the hawks; and in this he is followed by the poet Phile. Ælian, alſo, in another place deſcribes a manner of hunting with hawks in India, which, as we are told by ſeveral travellers, is ſtill practiſed in Perſia, where it is well underſtood, and by other eaſtern nations *.

It ſeems therefore, that the Greeks received from

Laxata condant ſubter ut ſe retia.
Quas Thraces arctis implicatas caſſibus
Cohorte denſa comprehendunt acriter,
Circiſque mercedem rependunt debitam,
His portionem largientes alitum.
Quod ni fit, ope poſt deſtitutos videris
Ponunt volantum cum laqueos rurſus gregi.

Geſner has collected in the work before quoted, page 43, all the information to be found reſpecting that ſpecies of hawk or falcon called κιρκος, circus.

* The Indians hunt hares and foxes in the following manner. They do not employ dogs, but eagles, crows, and, above all, kites, which they catch when young, and train for that purpoſe. They let looſe a tame hare or fox, with a piece of fleſh faſtened to it, and ſuffer theſe birds to fly after it, in order to ſeize the fleſh, which they are fond of, and which, on their return, they receive as the reward of their labour. When thus inſtructed to purſue their prey, they are ſent after wild foxes and hares in the mountains; theſe they follow in hopes of obtaining their uſual food, and ſoon catch them and bring them back to their maſters, as we are informed by Cteſias. Inſtead of the fleſh, however, which was faſtened to the tame animals, they receive as food the entrails of the wild ones which they have caught. *Æliani Hiſt. animal.* lib. iv. c. 26. Compare with this what Pluche ſays in *Nature diſplayed*, and the accounts given by Chardin and Gemelli Carreri.

India

India and Thrace the firſt information reſpecting the method of fowling with birds of prey; but it does not appear that this practice was introduced among them at a very early period. In Italy, however, it muſt have been very common, for Martial and Apuleius ſpeak of it as a thing every where known. The former calls a hawk a fowler's ſervant, and the latter makes uſe of a kind of pun on the word *accipiter*, which ſignified alſo a ſpecies of fiſh *. It cannot indeed be ſaid, that this art was ever forgotten; but, like other inventions, it was at firſt much admired, and afterwards neglected, ſo that it remained a long time without improvement; but it is certain that it was at length brought to the utmoſt degree of perfection. It is mentioned in the Roman laws †, and in writers of the fourth and fifth centuries.

Julius Firmicus Maternus, who in the time of Conſtantine the Great, about the year 336, wrote

* Prædo fuit volucrum, famulus nunc aucupis; idem
Decipit, et captas non ſibi mœret aves.
Martial. Epigr. lib. xiv. 216.

Apuleius, who had reſolved to examine every part of nature, having been accuſed of collecting ſea animals with indecent names for obſcene purpoſes, makes the following reply: "Memento tamen tam ridiculum argumentum fore, deſiderata ad res venereas marina obſcœna, quam ſi dicas marinum pectinem comendo capillo quæſitum, vel aucupandis volantibus piſcem accipitrem, aut venandis apris piſcem apriculum, aut eliciendis mortuis marina calvaria." Apologia, p. 296.

† I allude to the words in Digeſt. lib. xliii. tit. 24. 22. Ne is, qui duntaxat iter per fundum meum fecerit, aut avem egerit, venatuſve fuerit, ſine ullo opere, hoc interdicto teneatur.

his *Aſtronomicon*, in which he teaches the art of caſting nativities, aſſures us that thoſe who are born under certain ſigns will become great ſportſmen, and keep hounds and falcons *. Caius Sollius Apollinaris Sidonius, who lived about the year 480, celebrates Herdicius, his wife's brother, and ſon of the Emperor Avitus, becauſe he firſt practiſed in his territories hunting and fowling with dogs and hawks. The ſame author mentions hawking alſo in other parts of his work †. That this diverſion, however, has not been oftener ſpoken of and praiſed, is not much to be wondered at; for hunting, and all the concomitant arts, were at firſt employed for uſe, and in time prac-

* Thoſe born when the planet Venus is in Aquarius will be much given to hunting and fowling; in other things they will be ſlow, indolent, inactive and melancholy, and will apply to no laudable purſuit. They will however be fond of breeding hawks, falcons, eagles and other birds of the like kind, and horſes for hunting. They will be alſo very ingenious in ſuch exerciſes, and acquire by them a comfortable ſubſiſtence. Lib. v. c. 7.—This nativity diſplays a knowledge of mankind; for one may without much difficulty find princes and great men with whoſe lives it exactly correſponds, and who, to the great misfortune of their ſubjects and tenants, have undoubtedly been born under the ſign Aquarius. In the next chapter we find, "Equorum nutritores, accipitrum, falconum, cæterarumque avium quæ ad aucupia pertinent, ſimiliter et moloſſorum, vertagrorum, et qui ſunt ad venationes accommodati." See *Firmici Aſtronomicon*, lib. viii. Baſiliæ 1533. fol. p. 138, 139.

† Prætereo, quod hic primum gramina inceſſu, flumina natatu, venatu nemora fregiſti. Omitto, quod hic primum tibi pila, pyrgus, accipiter, canis, equus, arcus ludo fuere. *C. Sol. Apollinaris Sidon. Opera.* Pariſiis 1609. 4to. lib. iii. epiſt. 3. See alſo lib. iv. epiſt. 9, and carmen vii. ver 192.

tiſed

tiſed by ſervants, and eaſy means only of catching game were ſought for. But when luxury was introduced into ſtates, and the number of thoſe who lived by other people's labour became increaſed, theſe idlers began to employ that time which they had not learned to make a proper uſe of, or which they were not compelled to apply to more valuable purpoſes, in catching wild animals by every method that ingenuity could ſuggeſt, or in tormenting them by lingering deaths. Hunting and fowling, therefore, received many improvements by the aſſiſtance of art; and the indolent clergy even indulged in theſe cruel ſports, though often forbidden by the Church. Such prohibitions were iſſued by the council of Agda * in the year 506; by that of Epaon † in 517, by that of Macon ‡ in 585, and perhaps oftener, but never with much effect.

Before I proceed farther, I ſhall make two remarks. Firſt, that Pietro Creſcentio || gives one Daucus

* Concilii Agathenſis canone quinquageſimo quinto: "Epiſcopis, preſbyteris, diaconibus, canes ad venandum, aut accipitres, habere non liceat."

† Concilii Epaonenſis can. iv.

‡ Concilii Matiſconenſis ſecundi can. xiii: "Ubi Dei eſt aſſiduitas cantilenæ, monſtrum eſt, et dedecoris nota, canes ibi vel accipitres habitare."

|| E di queſti il primo trovatore che fu ſi dice il fu Dauco, il quale per divino intelletto connobbe la natura de gli ſparvieri et de falconi, et quelli dimeſticare et alla preda amaeſtrarli, et delle loro infermita di curarli; doppo il quale molti altri furono, che molti di quelli uccelli rapaci

Daucus as the inventor of the art of taming hawks, but without proof, or even probability. Secondly, that the ancients bred up to hunting and fiſhing ſeveral rapacious animals which at preſent are not uſed for that purpoſe, ſuch as the ſea-calf * and ſea-wolf †. Aſtruc ‡ has endeavoured to confute this idea: but his reaſoning appears to me to have little weight; and I agree in opinion with Rondelet || and Iſaac Voſſius §, that ſea-calves might be inſtructed to catch fiſh; I myſelf have ſeen ſome, that, when commanded by their maſter, exhibited a variety of movements and tricks which undoubtedly prove their aptneſs to learn.

The art of falconry ſeems to have been carried to the greateſt perfection, and to have been much in vogue at the principal courts of Europe, in the twelfth century. Some on that account have aſcribed the invention of it to the emperor Frederic I, and others to Frederic II. Frederic I, called

allaſcientia aggionſono. *Pietro Criſcentio d'agricoltura.* In Venetia 1542. 8vo. lib. ix. c. 1. Equally groundleſs is what we read in *Johannis Sariſbericnſis Policraticus.* Amſtelod. 1664. 8vo. lib. 1. cap. iv. Venationis aëreæ auctorem jactitant fuiſſe Machabeum, &c.

* Plin. lib. ix. cap. 8. Ælian. Hiſt. anim. l. ii. c. 11. Oppiani Halieut. l. v. 425.

† Plin. lib. x. cap. 8. Ariſtot. Hiſt. anim. l. ix. c. 36. Ælian. Hiſt. anim. l. vi. c. 65. Antigonus Caryſt. cap. 33.

‡ Mémoires pour l'hiſtoire naturelle de la province de Languedoc. Paris 1737. 4to. p. 568.

|| De piſcibus, lib. xvi. cap. 8.

§ In his obſervations on Mela, ii. 5. p. 483.

Barbaroſſa,

Barbaroſſa, was the firſt who brought falcons to Italy; at leaſt Pandolfo Collenuccio* ſays, that this was the common report, and Radevicus † ſeems to confirm it; but I do not know from what authority Pancirollus tells us that that emperor invented falconry at the time when he was beſieging Rome. Rainaldo, marquis of Eſte, was the firſt among the Italian princes who uſed this method of fowling ‡; and that the emperor Henry followed the example of his father, ſeems proved by the words of Collenuccio. The ſervice rendered by Frederic II to this art, if it can be ſaid to deſerve ſervice, is ſhewn by the book which he wrote in Latin on it, intitled *De Arte venandi cum avibus*, and which was printed

* Fu (Enrico) dato eſtremamente all' eſſercitio della caccia, et dell' uccellare con falconi, et uccelli di rapina; il qual modo d'uccellare, è fama, che Federico ſuo padre foſſe il primo autore, che lo portaſſe in Italia. *Compendio dell' iſtoria del regno di Napoli, di Pandolfo Collenuccio, di Mambrino Roſco e di Tom. Coſto.* In Venetia 1613. 4to. i. p. 88.

† In equis, canibus, accipitribus, cæteriſque ejus generis avibus inſtituendis, ſpectandis, circumferendis, nulli ſecundus. *Radevicus de geſtis Friderici* I. lib. ii. cap. ultimo.

‡ Aves autem aucupio natas, accipitres videlicet, falcones, girofalcos, peregrinos, montanos, gibboſos, aſtures, quos Pauſanias aſtorgios vocat, quæ primus in Italiam longo poſtliminio Federicus Ænobarbus advexit, ac cicures effici edocuit, primuſque ex Italia Rainaldus marchio Eſtenſis apud ſe in delitiis habuit, ad centum quinquaginta magnis expenſis aluit. *Bandellus Dominicanus, Orat. funebr. in princip. Mantuanum.*

Rhainaldus inter Italos omnium primus accipitres cicures, aſtures et id genus aquilas aluit, atque in delitiis habuit. *Cynthii Joan. Baptiſtæ Gyraldi de Ferraria et Ateſtinis princip. commentariolum, in Græevii Theſauro antiquit. et hiſtoriar.* vol. vii. p. 12.

for

for the firſt time at Augſburg in the year 1596, from a manuſcript belonging to Joachim Camerarius, a phyſician of Nuremberg *. It has here and there deficiencies, becauſe the manuſcript was torn, and ſome additions by the author's ſon Manfred, king of Sicily. In the ſecond book, there is an account of the uſe and manner of making hoods, called *capellæ*, which we are there told were invented by the Arabs. The emperor received as a preſent ſome hooded falcons from Arabian princes, and procured people from Arabia who underſtood the management of them †. Albertus Magnus has inſerted a great deal from the work of this emperor in his book upon animals.

* Reliqua librorum Friderici II imperatoris de arte venandi cum avibus, cum Manfredi regis additionibus;—ex membranis vetuſtis nunc primum edita. Albertus M. de falconibus, aſturibus et accipitribus. Auguſtæ Vindel. ad inſigne pinus 1596. 414 pages 8vo.

† As this work is extremely ſcarce, I ſhall here quote the following paſſage from it: "The hood had its origin among the oriental nations; for the eaſtern Arabs uſed it more than any other people with whom we are acquainted, in taming falcons and birds of the ſame ſpecies. When I croſſed the ſea, I had an opportunity of obſerving that the Arabs uſed hoods in this art. Some of the kings of Arabia ſent to me the moſt expert falconers, with various kinds of falcons; and I did not fail, after I had reſolved to collect into a book every thing reſpecting falconry, to invite from Arabia and every other country ſuch as were moſt ſkilful in it; and I received from them the beſt information they were able to give. Becauſe the uſe of the hood was one of the moſt effectual methods they knew for taming hawks, and as I ſaw the great benefit of it, I employed a hood in training theſe birds; and it has been ſo much approved in Europe, that it is proper it ſhould be handed down to poſterity"

In

In none of the ſports of the field have the fair ſex partaken ſo much as in falconry. The ladies formerly kept hawks, in which they greatly delighted, and which were as much fondled by thoſe who wiſhed to gain their favour as lap-dogs are at preſent *. What tended principally, however, to bring it into diſuſe, was the invention of gunpowder. After that, hawks were diſcarded, and the whole enjoyment of fowling was confined to ſhooting. Leſs ſkill and labour was indeed required in this new exerciſe; but the ladies abandoned the pleaſures of the chace, becauſe they diſapproved of the uſe of fire-arms, which were attended both with alarm and danger.

Among the oldeſt writers on Falconry, we may reckon Demetrius, who about the year 1270 was phyſician to the emperor Michael Paleologus. His book, written in Greek, was firſt printed at Paris in 1612, by Nicholas Rigaltius, from a manuſcript in the king's library, and with the Latin tranſlation of Peter Gyllius †. Some other works on the ſame ſubject, the antiquity of which is un-

* *Mémoires ſur l'ancienne chevalerie, par M. de la Curne de Sainte-Palaye.* Paris 1759—1781. 3 vol. 12mo. tom. iii. p. 183. In this work may be found many anecdotes reſpecting the taſte of the French ladies for the ſports of the field, in the ages of chivalry.

† Ιεραξοσοφιον. Rei accipitrariæ ſcriptores nunc primum editi. Acceſſit Κυνοσοφιον, Liber de cura canum. Lutetiæ 1612. 4to. See *Fabricii Biblioth. Græca*, lib. i. c. 25. vol. i. 155, where, however, the year 1619 is given wrong.

known,

known, were printed at the ſame time. One in the Catalonian dialect has the forged title of *Epiſtola Aquilæ, Symmachi et Theodotionis ad Ptolemæum regem Ægypti de re accipitraria.* All theſe writings treat chiefly on the rearing and diſeaſes of hawks; and contain cures, which, though ſome of them perhaps may be good enough, would not undoubtedly be all approved by any perſon of ſkill at preſent *. Aloes, to the ſize of about a bean, are ordered as a purge; and quickſilver is preſcribed for the itch and outbreaking. We are told alſo, that a wild and untractable falcon was confined ſome time with a hood on in a ſmith's ſhop, where it was ſoon tamed by the continual thumping of the hammers. One precept in Demetrius, reſpecting the art of falconry, ſeems very ill ſuited to the practice of modern times. He deſires ſportſmen to ſay their prayers before they go out to the field †. Had this cuſtom been continued to the preſent day, many great men would be like the people mentioned by a certain traveller, who ſolicit the aſſiſtance of God when they are preparing for a

* Among certain miſcellany tracts, written by Thomas Brown, London 1684, 8vo. p. 111. there is one with the following title: *Of hawks and falconry, ancient and modern*; which, however, conſiſts only of old phyſical preſcriptions. I mention this circumſtance, becauſe Grævius, in the preface to that part of his *Theſaurus*, page 6, where he gives ſome account of the hiſtory of falconry, laments that, on account of his being unacquainted with the Engliſh language, he had not been able to make uſe of this treatiſe of Brown.

† Τον θεον επικαλεσαντες.

piratical

piratical expedition *; but with this difference, that theſe rovers plunder only ſtrange ſhips, whereas the latter deſtroy the property and poſſeſſions of their own ſubjects.

TURF.

THE obſervation, that many kinds of earth, when dried, might be employed as fuel, may have eaſily been occaſioned by an accident in ſome place deſtitute of wood. A ſpark falling fortuitouſly on a turf-moor, during a dry ſummer, often ſets it on fire, and the conflagration it occaſions generally laſts ſo long, that it cannot eſcape notice †. Of the earth taking fire in this manner, there are many inſtances to be found in the ancients. One of the moſt remarkable is that men-

* Remarques d'un voyageur moderne au Levant. Amſterdam 1773. 8vo.

† In Siberia, a village which ſtood on a turf-moor was, on account of its marſhy ſituation, removed to another place, and that the remains might be more eaſily deſtroyed, they were ſet on fire. The flames, having communicated to the ſoil, which was inflammable, occaſioned great devaſtation; and when Gmelin was there, it had been continually burning for half a year. See *Gmelin's Reiſen durch Ruſsland in den jahren* 1768 *und* 69; vol. i. p. 22.

tioned

tioned by Tacitus *, who relates, that not long after the building of the city of Cologne, the neighbouring land took fire, and burned in ſuch a manner, that the corn, villages, and every production of the fields were deſtroyed by the flames, which advanced even to the walls of the city. I agree in opinion with Mr. Habel, who has lately quoted this remarkable paſſage †, that it is not to be underſtood as alluding to a vulcanic eruption, but to a moraſs which had been ſet on fire. In the duchy of Berg, and around Cologne, there are

* Civitas Juhonum malo improviſo afflicta eſt; nam ignes terra editi villas, arva, vicos paſſim corripiebant, ferebanturque in ipſa conditæ nuper Coloniæ mœnia, neque extingui poterant, non ſi imbres caderent, non ſi fluvialibus aquis aut quo alio humore niterentur; donec inopia remedii et ira cladis agreſtes quidam eminus ſaxa jacere, dein reſidentibus flammis proprius ſuggreſſi, ictu fuſtium, aliiſque verberibus, ut feras abſterrebant; poſtremo tegmina corpori direpta injiciunt, quanto magis profana et uſu polluta, tanto magis oppreſſura ignes. *Tacit. Annal.* lib. xiii. cap. 57. According as I underſtand the laſt words, the ruſtics, in deſpair, when they found that the fire could not be quenched either by rain or by the river-water which they poured over it, flung at laſt ſtones upon it, and throwing themſelves over theſe, cloſed up with their clothes, which were made of ſkins, all the interſtices between them; and theſe means may have been aſſiſted by their preſſure on the earth. I doubt, therefore, whether this circumſtance can be referred, as Mr. Habel thinks, to the ſuperſtitious cuſtom of throwing certain trifling things into fires in order to extinguiſh them.

† Beytrage zur naturgeſchichte und œconomie der Naſſauiſchen länder. Deſſau 1784. 8vo. p. 25. Some account of the turf moraſſes near Cologne may be found in *Hupſches Entdeckung des urſprungs des Cölniſchen umbers.* Frankf. und Leipzig 1771. 8vo.

very extenſive moraſſes, from which turf is dug up for fuel, and which undoubtedly ſerve to confirm this idea.

That the uſe of turf was well known in the earlieſt periods, in the greater part of Lower Saxony, and throughout the Netherlands, is fully proved by Pliny's account of the Chauci, who inhabited that part of Germany which at preſent comprehends the duchies of Bremen and Verden, the counties of Oldenburg, Delmenhorſt, Diepholz, Huy and Eaſt Frieſland. Pliny ſays expreſsly, that the Chauci preſſed together with their hands a kind of moſſy earth, which they dried by the wind rather than by the ſun, and which they uſed not only for cooking their victuals, but alſo for warming their bodies *. I explain alſo by turf a ſhort paſſage of Antigonus Caryſtius, quoted from Phanias, in which it is ſaid that a moraſs in Theſſaly, having become dry, took fire and burned †.

The account, therefore, given in ſome Dutch chronicles, that turf and the manner of preparing it were firſt found out about the year 1215, and that about 1222 it had become common, is cer-

* Captum manibus lutum ventis magis quam ſole ſiccantes, terra cibos et rigentia ſeptentrione viſcera ſua urunt. *Hiſt. nat.* lib. xvi. c. 1.

† Φανιαν δε, την των Πυρακων λιμνην ὁταν ξηραν᾽ῃ, καισθαι. Phaniam, paludem Pyracum, ſiccatam ardere. Meurſius ſays that the reading ought to be των Πελλαιων, and he is of opinion that it means a part of Theſſaly called by Stephanus Πελλα.

tainly

tainly falſe *. This information may be applicable to certain lands and diſtricts, and correct as to the

* De Wolt-luyden, die nu nieuwe manieren van goed te ghewinnen, in het graven van den torff, gevonden hadden, in voortiiden onbekent, ofte ten minſten ſo ſeer ghemeen niet, hebben oock uyt goeden yver ten tiiden van den Abt Siardus, de ſeer godſdienſtich ende nederich was, het Clooſter Mariengaerd veele veenen in ende ontrent Beccafeen geſchonken. "The foreſters, who had then got a new employment, that of turf-digging, which had been before unknown, or at leaſt very uncommon, gave as a preſent to the monaſtery of Mariengard, in 1215, ſeveral turf-moſſes in and near Backefeen." That monaſtery was ſituated at the diſtance of two miles from Leeuwaarden. The words *Wolt-luyden*, *Wout-lieden*, *Woud-lieden* occur in the old laws of the mines of Goſlar, which Leibnitz has inſerted in *Scriptor. Brunſv.* vol. iii. In the introduction it is ſaid, Sylvani, qui in legibus vocantur *die Woltleute* item *Wold-werchten* id eſt *Waldgewerke*. Eorum ſub nomine continentur et montani, ſeu homines in metallis ſeu fodinis et officinis fuſoriis occupati, qui paſſim per ſylvas vicinas diſperſi agebant. Nam in legibus metallicis diſerte cavetur, ut, quando de novis legibus ferendis agitur, Sex-viri convocent Sylvanos, et quod pluribus placuit ſequantur.

In *Kronijck der Kronijcken, door S. de Vries*, printed at Amſterdam in 1688, in five volumes 4to. the following paſſage occurs, vol. v. p. 553: Ontrent deſe tijd (1221) is de turf-gravingh eerſt regt opgekoomen; welck de geleedene ſchaede en ellende door de zee-wateren eenigſins vergoedede en verſoetede; waer door oock veele ſeer riick wierden: "About this time (1221) the digging of turf was firſt practiſed, which in ſome meaſure made amends for the damage occaſioned by the ſea-water, and by which ſeveral acquired great riches."

Some Dutch writers make turf-digging to be of much higher antiquity, and in ſupport of this opinion quote an old chronicle in rhyme, in which mention is made of a donation by Gerolf count of Frieſland, in the following words: *Dat hi gaf boſch, merſch ende zant.* They explain *merſch* by *moergrond*, moſs; but I am not acquainted with the antiquity of that chronicle; and of the letter of donation there is only a Flemiſh tranſlation, which, with ſome extracts from the chronicle, may be found in *D'oude chroniicke end hiſtorien van Holland, door W. van Gouthoeven*. Tot Dortrecht 1620, fol. p. 237. See alſo *Natuurlyke hiſtorie van Holland, door J. le Francq van Berkhey Tweededeel.* Amſterd. 1769. 8vo. p. 552.

introduction

introduction of this kind of fuel in thoſe parts; for the uſe of it was not extended far till a late period; and even yet, turf is neither employed nor known in many places which poſſeſs it, even though they are deſtitute of wood *. Some improvement in the manner of preparing turf may have alſo been conſidered as the invention of this fuel, which is undoubtedly of greater antiquity. What induced Monconys to aſcribe the invention of turf to raſmus, or who firſt propagated that error, I can as little conjecture as Miſſon †.

In latter times turf began to be burned to coal, ſometimes in kilns and ſometimes in furnaces built for that purpoſe, by which this advantage is obtained that it kindles ſooner, burns with leſs air, and forms a more moderate and uniform fire, without much ſmoke, though it is not ſo laſting as turf, becauſe it has loſt the greater part of its inflammable ſubſtance. This method of reducing turf to coal, which is ſtill practiſed in ſome parts of Bohemia, Sileſia, and Upper Saxony, was, it appears, propoſed about the year 1669, by the well-known John Joachim Becher, who recommended at that time a

* The uſe of turf was firſt made known in France in the year 1621, by Charles de Lamberville, advocate of the parliament of Paris, who reſided ſome time in Holland, to which he had been ſent by the king on public buſineſs. See *Anciens mineralogiſtes, par Gobet*, i. p. 302.

† Journal des voyages de Monconys. Lyon 1666. 2 vol. 4to. ii. p. 129. C'eſt lui (Eraſme) qui a donné l'invention de la tourbe, qu'on bruſle au lieu du charbon. See alſo Miſſon's Travels.

method of depriving coals of their ſulphur by burning them, and the uſe of rock-oil procured from them by that proceſs *. The burning of turf to coal ſeems to have been firſt made known in Germany by Hans Charles von Carlowitz, chamber-counſellor, and principal ſurveyor of the mines of the electorate of Saxony. To ſave wood and pro-

* "In Holland there is turf, and in England there are coals, neither of which are good for burning either in apartments or in melting-houſes. I have, however, diſcovered a method of burning both theſe to good coals, ſo that they ſhall not only produce no ſmoke or bad ſmell, but yield a heat as ſtrong for melting metals as that of wood, and throw out ſuch flames that a foot of coal ſhall make a flame ten feet long. This I have demonſtrated at the Hague with turf, and proved here in England with coals, in the preſence of Mr. Boyle, by experiments made at Windſor on a large ſcale. It deſerves to be remarked on this occaſion, that as the Swedes procure their tar from fir wood, I have procured tar from coals, which is in every thing equal to the Swediſh, and even ſuperior to it for ſome purpoſes. I have tried it both on timber and ropes, and it has been found excellent. The king himſelf ordered a proof of it to be made in his preſence. This is a thing of very great importance to the Engliſh, and the coals after the tar has been extracted from them are better for uſe than before." *Nærriſche weiſheit und weiſe narrheit.* Frankfurt 1683. 12mo. p. 91. Boyle ſeems to ſpeak of this invention in *The uſefulneſs of natural philoſophy*, London 1774, fol. i. p. 515, or the Latin tranſlation *Exercitationes circa utilitatem philoſophiæ nat. experimentalis*, Genevæ 1694, 4to. p. 245. At preſent, the burning of coals in order to procure from them rock-oil, uſed particularly by the leather-manufacturers, and which on that account muſt not be exported, is much practiſed in England. It appears, however, that ſomething of the like kind was attempted before Becher's time; for in the year 1627, John Hacket and Octav. Strada obtained a patent for their invention of rendering coals as uſeful as wood for fuel in houſes without hurting any thing by their ſmoke. See *Anderſon's Hiſtory of Commerce*, vol. v. p. 42.

mote

mote the benefit of the mines, he ſought for turf; and having diſcovered it, he then endeavoured to find out ſome method of rendering it fit to be employed in the melting-houſes, and this was the reducing to coal, which, as he himſelf ſays *, he firſt attempted in kilns at Scheibenberg, in the year 1708.

ARTICHOKE.

THAT I might be able to inveſtigate whether our artichoke was known to the ancients, I have not only collected a variety of ſcattered paſſages, compared them with one another and with nature, and laboured through a tedious multitude of contradictions and a confuſion of names; but I have alſo been obliged to examine a load of groundleſs conjectures, heaped together by commentators †, in order that I might underſtand them and aſcertain their value. By theſe means, I have learned more than ſeems hitherto to have been known;

* Von Carlowitz, Sylvicultura œconomica, oder wild baum zucht, Leipzig 1713, fol. p. 430, where an account is given of the firſt experiment.

† See J. Bodæus a Stapel, Erklärung über die geſchichte der pflanzen des Theophraſt, p. 618. Salmaſius ad Solinum, p 159, and his Exercitationes de homonymis, p. 76. Caſauboni Animadverſiones in Athen. Dipnoſoph. Lugduni 1621, fol. p. 146. J. Bauhini Hiſtor. plant. iii. p. 48.

and I have found that more is believed than can be proved; but that the fruits of my toil will give complete ſatisfaction to my readers, I do not pretend to hope. Before the botany, however, and the natural hiſtory in general of the ancients be properly elucidated; before truth be ſeparated from falſehood; what is certain from what is uncertain; and things defined from thoſe which are undefined, reſearches of this kind muſt not be deſpiſed, and the ſame method as that which I have followed muſt be adopted.

As all thoſe, perhaps, who have a taſte for illuſtrations of ancient authors, may not be ſo well acquainted with the nature, properties, culture and uſe of our artichoke, as the diſſertation I propoſe may require, I ſhall endeavour to ſupply that deficiency. Our artichoke appears to thoſe who have not ſtudied the natural claſſification of plants to have an affinity to the thiſtle kind, and the calyx and leaves ſeem to warrant this opinion; the former by its ſcale-diſpoſed figure, as well as the flower it contains; and the latter by their prickles, which they, however, loſe by art and cultivation. The ſeeds which are procured from Italy, becauſe they do not ripen with us, are ſown in the ſpring. Of the young plants, thoſe alone which are prickly are tranſplanted: the reſt are thrown away, as they would produce only ſmall tops. When the plants grow up, they ſhoot forth ſlips, which are taken up, and which may be tranſplanted throughout the whole

whole ſummer. The calyx, before the blue flowers burſt out, is cut off, and dreſſed ſometimes freſh, and ſometimes it is pickled for the winter. The only part eatable is the thick pulpy bottom, which ſupports the flowers with their then imperfect ſeeds and the woolly ſubſtance which adheres to them. Another ſpecies of the ſame genus, the *cynara cardunculus*, cardoons, or Spaniſh cardoons, is reared in our gardens, not on account of its flower, but of the pulpy ribs of its leaves, and tender ſtalk. When this plant attains the height of about ſix feet, it is bound round in ſuch a manner that the leaves are compreſſed to the ſtem. It is then ſurrounded with earth and dung, and under this covering it in a few weeks becomes ſo white and tender, that the above-mentioned parts may be dreſſed and eaten, or made into ſoup. The ribs of the leaves, however, of the firſt kind, or proper artichoke, may be rendered eatable in the ſame manner, and are then as fit for uſe as the latter.

The names of plants in ancient authors which have been applied to our artichoke, are the following: *cinara*, *carduus*, *ſcolymus* and *cactus*.

The *cinara*, which is originally a Greek word *, belonged certainly to the thiſtle-ſpecies; and the

* In the time of Galen and Athenæus it was written ſometimes κινάρα, and ſometimes κυνάρα: *Salmaſius de homonymis*, p. 77.

deſcription of its top, as given by Columella *, ſeems, as has already been remarked by Nonnius † and others, to agree perfectly with that of our artichoke. The *cinara* was commonly furniſhed with prickles, but that was preferred which had loſt them by cultivation, and for which, means were preſcribed that did not produce the deſired effect ‡. It was raiſed from ſeed ſown in ſpring, but was propagated alſo from ſlips or ſhoots which in Italy were planted in autumn, that they might bear earlier the next ſummer ||. The direction given to water theſe plants frequently, is ſtill

* Hiſpida ponatur cinara, quæ dulcis Iaccho
Potanti veniat, nec Phœbo grata canenti.
Hæc modo purpureo ſurgit glomerata corymbo,
Myrtiolo modo crine viret, deflexaque collo
Nunc adaperta manet, nunc pinea vertice pungit,
Nunc ſimilis calatho, ſpiniſque minantibus horret,
Pallida nonnunquam tortos imitatur acanthos.
Colum. lib. x. ver. 235.

Theſe lines are not perfectly clear, as the learned editor himſelf confeſſes. I read *adaperta*, on the authority of an ancient manuſcript, and have therefore inſerted it in the above paſſage.

† Hanc deſcriptionem optime quadrare cum planta illa quæ vulgo Artachoches dicitur, nemo eſt qui negabit, modo Columellæ verſus cum ipſa planta conferre voluerit. *Ludovici Nonnii Diæteticon, ſive de re cibaria.* Antverpiæ 1646. 4to. p. 56.

‡ It was ſaid, that if the corners of the ſeeds were bruiſed, no prickles would be produced. See *Geopon.* lib. xii. cap. 39.

|| Cinaræ ſobolem melius per autumni æquinoctium diſponemus; ſemen commodius circa calendas Martii ſeremus. *Geopon.* l. c. *Columella*, xi. cap. 3.

followed

followed by our gardeners in reſpect to their artichokes, and they expect from this attention, that the fruit will be more abundant and tender. By this method many give to their artichokes a ſuperiority which others that have not been watered ſo carefully cannot attain *. A complaint, which occurs in ancient authors, is alſo prevalent, that the roots are often deſtroyed by mice †. I do not, however, find it remarked what part of the *cinara* was properly uſed, but it may be conjectured it was the top, becauſe the tender fruit is praiſed ‡.

Carduus, among the Romans, was the common name of all plants of the thiſtle kind. It occurs among thoſe of weeds ‖, and may be then properly tranſlated by the word *thiſtle*. It, however, often ſignified an eatable thiſtle; and this has given Pliny occaſion to make uſe of an inſipid piece of raillery, when he ſays, that luxury prepared as food to man what would not be eaten by cattle §.

* Æſtate rigato ipſas, et quidem frequenter. *Geopon.* p. 925.

† Geopon. 926.

‡ Geopon. 925, where repeated watering is directed, it is ſaid: Ουτω γαρ ἁπαλον και αδρυτερον τον καρπον ἐξεις; you will then have tenderer fruit and in more abundance.

‖ Virgil. Geor. i. 150. Plin. lib. xviii. cap. 17.

§ Poterant videri dicta omnia quæ in pretio ſunt, niſi reſtaret res maximi quæſtus, non ſine pudore dicenda. Certum eſt quippe carduos apud Carthaginem magnam, Cordubamque præcipue, ſeſtertium ſena millia e parvis reddere areis; quoniam portenta quoque terrarum in ganeam vertimus, etiam ea quæ refugiunt quadrupedes conſciæ. *Plin.* lib. xix. cap. 8.

It is an old and common fault, that when the Greek and Roman authors have not given us ſuch deſcriptions of natural objects as are ſufficient to enable us to aſcertain exactly what they are, it is ſuppoſed that they have been known under different names, and a variety of characteriſtics are drawn together to enable us to determine them. What, for example, we find reſpecting the *cinara* is too little to give a juſt idea of the plant: we read ſomewhat more of the *carduus*; and becauſe between theſe there ſeems to be an affinity, it is concluded that the *cinara* and the *carduus* were the ſame plant; and every thing told us reſpecting both of them is thrown into one. Some even go farther, and add what they find under a third or a fourth name. It is indeed true, that many natural objects have had ſeveral names, and the ſpecies may ſometimes be rightly gueſſed: but conjecture ought never to be admitted unleſs the identity can be fully eſtabliſhed; elſe one may form ſuch a monſtrous production as Horace has delineated, when he ſays,

> Humano capiti cervicem pictor equinam
> Jungere ſi velit, et varias inducere plumas,
> Undique collatis membris—

I wiſh commentators would follow the example of our naturaliſts, who conſider a plant as a diſtinct ſpecies until it has been proved, on ſure grounds, that it is nothing elſe than a variety of a plant already characteriſed. I ſhould not therefore affirm, that

that the *cinara* and the *carduus* are the ſame, were I not able to produce the following inconteſtable proofs in ſupport of my aſſertion.

In the firſt place, the Latins, Palladius and Pliny, give us the ſame account of the *carduus* that Columella and the Greeks do of the *cinara*. The former loſt its prickles through cultivation *; its flowers were alſo of a purple colour †; it was propagated by ſeed and by ſhoots ‡; it required frequent watering ||; and it was remarked that it throve better when the earth was mixed with aſhes §. Had not the *carduus* and the *cinara* been the ſame, Palladius and Pliny would have mentioned the latter; for we cannot ſuppoſe that they otherwiſe would have omitted a plant that formed a diſh ſo much eſteemed and ſo well known among their countrymen. The latter claims to himſelf

* Palladius, iv. 9. p. 934, and lib. xi. Octob. p. 987. In the firſt-mentioned place he gives the ſame direction for preventing prickles, as that quoted reſpecting the *cinara*. "Si acumina feminum confringas, ſpinis carebunt."

† Florem purpureum mittit inter medios aculeos, celeriter caneſcentem et abeuntem cum aura. "The wind eaſily carries away the withered flowers on account of their woolly nature." *Plin.* lib. xx. cap. 23.

‡ Pallad. l. c.

|| Pallad. p. 934, Rigentur, ſi æſtus intervenit.

§ Pallad. xi. Octob. xi. p. 987: Cinerem ſæpe ſub hieme diebus ſiccis, ſimumque miſcebimus. *Columella*, lib. xi. cap. 3, ſpeaking of *cinara*, ſays, Multo cinere ſtercorabimus; id enim genus ſtercoris huic oleri videtur aptiſſimum. The ſame thing is ſaid by the Greeks.

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the merit of having paſſed over no one that was held in eſtimation. In the ſecond place, Virgil has tranſlated the word *cynaros* in a part of Sophocles now loſt, by *carduus* * ; thirdly, Athenæus ſays expreſsly, that the *cinara* was by the Latins named *cardus* and *carduus* † ; and, laſtly, the old gloſſaries explain *cinara* by *carduus*, as we are told by Salmaſius. On theſe grounds, therefore, I am of opinion that the *cinara* and the *carduus* were the ſame.

We are informed by Apicius ‡ and Pliny § in what manner the *carduus* was dreſſed by the ancient cooks. The latter gives directions for pickling it in vinegar; but neither of them tells us what part of it was eaten. Liſter thinks that Apicius ſpeaks of the tops of the young ſhoots, which, as far as I know, are parts of the artichoke never eaten at preſent. It is, however, worthy of remark, that the tops *(turiones)* of certain kinds of the thiſ-

* Κυναρος ακανθα παντα πληθυει γυην.
Cinara ſpinoſa toto inhorret vomere.
Sophocles, in Phœnice.

- - - - - - - - Seguiſque horreret in arvis
Carduus.
Virgil. Georg. i. 50.

See Salmaſ. ad Solin. p. 161 and 162.

† Athen. Deipnoſ. at the end of the ſecond book, p. 70. Salmaſius, in his Remarks on Solinus, p. 159, is of opinion that Athenæus wrote καρδον, not καρδυον; and the Latins not *carduus*, but *cardus*.

‡ Apic. de arte coquin. lib. iii. cap. 19.

§ Cardui condiuntur aceto melle diluto, addita laſeris radice et cumini, ne quis dies ſine carduo ſit. *Plin.* lib. xix. cap. 8.

tle

tle ſpecies of plants, and among theſe the common burr *, are, in ſome countries, dreſſed and eaten like aſparagus. It is not improbable alſo that Pliny and Apicius may have meant the ribs of the leaves; though none of the ancients has taught us the art of binding up, covering with earth, and blanching the *cinara* or *carduus*. This, perhaps, was a new invention of the gardeners; and the cooks may have had other methods of rendering the ribs of the leaves tender and eatable. Had they meant the bottom of the calyx, they would not have omitted to give a circumſtantial account of the preparation, previous to its being pickled.

The *ſcolymus* is by Pliny and Theophraſtus reckoned to belong to the genus of the thiſtles. The former ſays, that, like moſt others of the ſame kind, the ſeeds were covered by a ſort of wool *(pappus)* †. It had a high ſtem, ſurrounded with leaves ‡, which were prickly, but which ceaſed to

* *Arctium lappa*, an indigenous weed, difficult to be rooted out. Elſholz, in his *Gartenbau*, quarto edition, of 1684, ſpeaking of the Spaniſh cardoons, ſays, The ſtrong ſtem of the large burr, *lappa major*, C. B. may be dreſſed in the ſame manner, and is not much different in taſte. Haller, in *Hiſt. plant.* i. p. 70, obſerves, Radices edules ſunt, ſapore cynaræ. See alſo *Laurembergii Horticultura*, p. 190; *Kalms Reiſe*, iii. p. 318; Thomas Moufet's Health's improvement. Lond. 1746. 8vo. p. 217.

† Theophraſt. Hiſtor. plant. lib. vi. cap. 4. where σκολυμος is tranſlated by *carduus*: γηρασκων δε το ανθος εκπαπποῦται, ſeneſcens flos in lanuginem pappum vocatam convertitur.

‡ Dioſcor. lib. iii. cap. 16.

ſting

ſting when the plant withered *. It flowered the whole ſummer through, and had often flowers and ripe ſeed at the ſame time; which is the caſe alſo with our artichoke plants †. The calyx of the *ſcolymus* was not prickly ‡; the root was thick, black, and ſweet, and contained a milky juice. It was eaten both raw and cooked; and Theophraſtus obſerves, as ſomething very remarkable, that when the plant was in flower, or, as others explain the words, when it had finiſhed blowing, it was moſt palatable. What renders this circumſtance ſingular is, that moſt milky roots, uſed for food, loſe their milk and become unfit to be eaten as ſoon as they have blown. This is the caſe with the goat's beard, which is eatable only the firſt year.

The *ſcolymus*, however, is not the only plant which forms an exception; for the garden ſcorzonera retains its milk, and continues eatable after it has bloomed, and as long as it has milk it may be uſed. According to Theophraſtus and Pliny, the roots of the *ſcolymus* are eatable. On the other hand, Dioſcorides ſays, that the roots were not

* Aculei areſcente folio deſinunt pungere. *Plin.* lib. xxi. cap. 6.

† Mirum quod ſine intervallo tota æſtate aliud floret in eo genere, aliud concipit, aliud parturit. *Plin.* lib. c. Theophraſtus ſays the ſame, p. 613.

‡ Theophraſtus: ἡ δε κυησις ουκ ακανθωδης, αλλα προμηκης αυτου. Conceptus non ſpinoſus, ſed oblongus. But Dioſcorides ſays, κεφαλη ακανθωδης, capitulum ſpinoſum. This contradiction, and other ſmall variations, have induced ſome to conſider the *ſcolymus* of Theophraſtus, and that of Dioſcorides, two different plants.

 eaten,

eaten, but the young leaves only: as he informs us, however, that they were dreſſed like aſparagus, it would appear that he meant the young ſhoots *. Theophraſtus expreſsly tells us, that, beſides the roots, the flowers † alſo were uſed as food; and he calls that which was eatable the pulpy part. We have, therefore, full proof that the ancients ate the tops of ſome plants, in the ſame manner as we eat our artichokes.

It may however be aſked, what kind of a plant was the *ſcolymus?*—That it was different from the *cinara* is undoubtedly certain; for Dioſcorides ‡ expreſsly diſtinguiſhes them; nor was it the eatable *carduus*, for Pliny compares it with the *carduus* §, and ſays that it was characteriſed from the latter by having roots fit to be eaten ‖. Stapel is of opinion that the *ſcolymus* is our artichoke; but this ſeems to me improbable, for the leaves and roots of the latter are not ſweet, but harſh and bitter, and the calyx is prickly, which was not the caſe in the *ſcolymus* of Theophraſtus. Beſides, I find nothing in

* Ἡ δε ποια αρτιφυης ουσα, λαχανευεται ἑφθη ὡσπερ ασπαραγος. Herba vero recens nata, ſi aſparagi modo elixetur, oleris vicem ſubit. *Dioſcor.* iii. 16.

† Ἡ δε του ογκου κινησις σαρκωδης και εδωδιμος. Pars craſſior carnoſa, ciboque idonea.

‡ Dioſcor. lib. iii. cap. 10, where he ſays of a plant that its leaves were like thoſe of the σκολυμος, and its ſtem like that of the κιναρα.

§ Lib. xxi. cap. 16.

‖ Scolymus carduorum generis ab iis diſtat, quod radix ejus veſcendo eſt decocta. Pag. 250.

the

the whole deſcription of the *ſcolymus*, or in the accounts given us by the ancients of the *cinara* and *cardus*, that can be applied to our artichoke alone, and not to any other plant. It may be here replied, that it would be very difficult to aſcertain plants from the names of the ancients, were ſuch ſtrong proofs required, becauſe they had not the art of ſeparating the different genera correctly, and of aſſigning to each certain characterizing marks. This I allow; and for that reaſon it is impoſſible to elucidate properly the Greek and Latin names of plants; but, in my opinion, it is better to confeſs this impoſſibility, than to deceive oneſelf with diſtant probabilities. Let the genus be aſcertained when one cannot aſcertain the ſpecies; let the order to which the plant belongs be determined when one cannot determine the genus; or, at leaſt, let the claſs be aſſigned when there is ſufficient authority to do ſo. The *cinara*, *carduus*, and *ſcolymus* were, therefore, ſpecies of the thiſtle, of which the roots and young ſhoots, and alſo the bottom of the calyx of the laſt, were eaten. Were I appointed, or condemned, to form a new Latin dictionary, I ſhould explain the article *ſcolymus* in the following manner: *Planta compoſita, capitata. Caulis longus, obſitus foliis ſpinoſis. Radix carnoſa, lactescens, nigra, dulcis, edulis. Calix ſquamis inermibus, diſco carnoſo, ante efflorescentiam edulis. Semina pappoſa. Turiones edules.* This deſcription, ſhort as it is, contains every thing that the ancients have

ſaid

ſaid in order to characterize that plant. It can, indeed, be underſtood only by thoſe who are acquainted with the terms of botany; but what follows will require no explanation, or defining of botanical names.

Should it be ſaid that the *ſcolymus* muſt be our artichoke, becauſe no other plant of the thiſtle kind is known the bottom of the calyx of which is eatable, I would in anſwer obſerve:—Firſt, other ſpecies may have been known in ancient times, which, perhaps, have been diſuſed and forgotten ſince the pleaſanter and more delicious artichoke became known. It is certain that many old plants have in this manner been baniſhed from our gardens by the introduction of new ones. Thus have common alexanders * fallen into neglect ſince celery was made known by the Italians, about the end of the laſt century; and ſo at preſent has the cultivation of winter-creſſes †, bulbous-rooted chærophyllum ‡, rocket §, and others, been abandoned ſince better vegetables have been obtained to ſupply their place. Secondly, it is certain that, even at preſent, the bottom of the calyx of ſome others of the thiſtle-kind, beſides the genus of the artichoke, is eaten; ſuch as the cotton-thiſtle ‖,

* Smyrnium oluſatrum. See my Grundſatze der Teutſchen landwirthſchaft, p. 117.

† Eryſimum barbarea.

‡ Chærophyllum bulboſum.

§ Braſſica eruca.

‖ Onopordum acanthium. See Halleri Hiſt. plant. i. p. 69. Linnæi Amœn. academ. vol. vi. p. 124.

and the carline thiſtle *, without mentioning the ſun-flower, which has been brought to us in modern times from South America.

Without engaging to examine all the hypotheſes of commentators and ancient botaniſts on this ſubject, I ſhall take notice of one conjecture which, upon mature conſideration, appears to have ſome probability. Cluſius † is of opinion that the plant called by the botaniſts of the laſt century *carduus chryſanthemus*, and by thoſe of the preſent age *ſcolymus Hiſpanicus*, the golden thiſtle, is the *ſcolymus* of Theophraſtus; becauſe its leaves, beſet with white prickles, and its pulpy, ſweet, milky roots are eaten, and excel in taſte all roots whatever, even thoſe of ſkirret; and becauſe it was collected and ſold in Spain, Italy, and Greece. But what has principally attracted my attention to this conjecture, is the account of Bellon ‡ that this plant in

* Carlina acaulis. Haller. l. c. p. 80. Lin. l. c.

† Cluſii Rariorum plantarum hiſtoriæ, lib. iv. p. 153.

‡ In Crete there is a kind of prickly plant, which, in the common Greek idiom, is generally called *aſcolimbros*. The ancient Latins called it alſo by a Greek name, *glycyrrhizon*, though different from *glycyrrhiza* (liquorice). It grows every where ſpontaneouſly, has a yellow flower, and abounds with a milky juice. The roots and leaves are uſually eaten before it ſhoots up into a ſtem. We ſaw it expoſed to ſale, with other herbs, in the market-place of Ravenna, and at Ancona, where the women, who were digging it up, gave it the name of *riuci*. We ſaw it gathered alſo in the Campagna di Roma, where the inhabitants called it *ſpinobarda*. This is the plant which by the modern Greeks is named *aſcolimbrous*. *Bellonii Obſervationes*, lib. i. cap. 18, added

in Crete or Candia is called ſtill by the Greeks there *aſcolymbros*. This name ſeems to have ariſen from *ſcolymos*; and beſides Stapel * found in an old gloſſary the word *aſcolymbros*. I am likewiſe convinced that, as Tournefort † has ſaid, the botany of the ancients would be much illuſtrated and rendered more certain, were the names uſed by the modern Greeks known. It is certain that many old names have been preſerved till the preſent time with little variation; but I can, nevertheleſs, as little admit the aſſertion of Cluſius as that of Stapel; for *ſcolymus hiſpanicus* has neither the bottom of the calyx pulpy, nor wool adhering to the ſeeds, like the *ſcolymus* of Theophraſtus; and the young roots only can be eaten, becauſe, like thoſe

added to *Cluſii Exotica*, p. 24. - - - - which in Crete is called *aſcolymbros*, and in Lemnos *ſcombrouolo*, that is *ſcombri carduus*. This thiſtle abounds with a milky juice, like ſuccory, has a yellow flower, and is excellent eating; ſo that I know no root cultivated in gardens which can be compared in taſte to the *aſcolymbros*, the parſnip not even excepted. Page 31.

* Theophraſt. Hiſt. plant. p. 620. The figure which Stapel gives, p. 621, is not of the *ſcolymus hiſpanicus*, but of *ſcolymus maculatus*. It is taken from Cluſius, who has alſo a figure of the former.

† I conſidered the heads of theſe poor Greeks as ſo many living inſcriptions, which preſerve to us the names mentioned by Dioſcorides and Theophraſtus. Though liable to different variations, they will, doubtleſs, be more laſting than the hardeſt marble, becauſe they are every day renewed, whereas marble is effaced or deſtroyed. Inſcriptions of this kind will preſerve, therefore, to future ages the names of ſeveral plants known to thoſe ſkilful Greeks who lived in happier and more learned times. *Voyage du Levant*, i. p. 34. Compare with the above what Haller ſays in his *Biblioth. botan.* i. p. 28.

of moſt plants of the genus of the thiſtle, they loſe their milk when the flower is in bloom; laſtly, the leaves retain their power of pricking, even after they have become withered.

The fourth name which, with any kind of probability, has been tranſlated by the word artichoke is *cactus*. This plant, which, in the time of Theophraſtus and Pliny, grew only in Sicily, and not in Greece, had broad prickly leaves *; the flower was filled with a kind of wool, which, when it was eaten inadvertently, was pernicious †; the calyx was prickly; and, beſides a long ſtem, it ſhot forth branches which crept along the ground ‡, and

* Cactos quoque in Sicilia tantum naſcitur, ſuæ proprietatis et ipſe; in terra ſerpunt caules, a radice emiſſi, lato folio et ſpinoſo. Caules vocant cactos, nec faſtidiunt in cibis, inveteratos quoque. Unum caulem rectum habent, quem vocant pternica, ejuſdem ſuavitatis ſed vetuſtatis impatientem. Semen ei lanuginis, quam pappon vocant; quo detracto et cortice, teneritas ſimilis cerebro palmæ eſt; vocant aſcalian. *Plin.* lib. xxi. cap. 16. See *Theoph.* lib. vi. cap. 4. Theocritus, Idyll. x. 4. mentions a lamb wounded in the foot by a *cactus*: τας τον ποδα κακτος ετυθεν. The ſcholiaſt upon this obſerves, κακτος δε ειδος ακανθης. Tertullian names this plant among prickly weeds, together with the *rubus*, in the end of the ſecond chapter of that unintelligible book *De Pallio*. De la Cerda, in his excellent edition of *Opera Tertulliani*, Lutetiæ Pariſ. 1624. 2 vol. fol. i. p. 13, reads *carecto* inſtead of *cacto*; but Saumaiſe, in his edition of that work, p. 172, has ſufficiently vindicated the latter. *Antigonus Caryſt.* chap. 8, calls κακτος a Sicilian kind of thiſtle.

† Dioſcorid. Alexipharm. cap. 33.

‡ Αφιησι γαρ ευθυς απο της ριζης καυλους επιγειους. Statim ab radice caules repentes in terram mittit. *Theoph.* p. 613. Such plants with creeping branches he calls, lib. vii. c. 8. p. 819, επιγειοκαυλα.

which,

which, when the outer rind had been peeled off, were eaten either freſh, or pickled in ſalt water*. The bottom of the calyx of this plant was likewiſe uſed, after it had been freed from its ſeeds and woolly ſubſtance †. It had a great reſemblance to the pith of the palm-tree ‡.

That the *cactus* was different from the *ſcolymus* we are expreſsly told by Theophraſtus; and Pliny alſo diſtinguiſhes them both from each other and from the *carduus*. Athenæus § is the only author who ſays that the *cactus* and the *cinara* were the ſame; but he gives no other proof than a very ſimple etymology. It muſt, therefore, be admitted that the *cactus* was a ſpecies of the thiſtle kind entirely different from any of the former.

I think I have proved, therefore, that the Greeks and the Romans uſed the pulpy bottom of the ca-

* The creeping branches were in particular called *cacti*, the upright ſtem *pternix*.

† Theophraſtus calls the bottom of the calyx περικαρπιον, a word which in botany ſtill retains the ſame meaning as that author explains it, lib. i. c. 3 and 4. See Bodæus's Obſervations, p. 10 and 628. Theophraſtus, however, ſays likewiſe, that the ſame part of the *cactus* was called alſo σκαλια; from which is derived the *aſcalia* of Pliny. Galen calls it σπονδυλον.

‡ Εμφερες τω του φοινικος εγκεφαλω. Simile cerebro palmæ. *Theoph.* This term is explained by Pliny, lib. xiii. c. 4: Dulcis medulla palmarum in cacumine, quod cerebrum appellant.

§ Athen. Deipnoſ. at the end of the ſecond book, p. 70. He gives every thing to be found in Theophraſtus; but either the author or ſome of his tranſcribers have ſo confuſed what he ſays, that it is almoſt unintelligible.

lyx, and the tendereſt ſtalks and young ſhoots of ſome plants reckoned to belong to the thiſtle kind, in the ſame manner as we uſe artichokes and cardoons; and that the latter were unknown to them. It appears to me probable that the uſe of theſe plants, at leaſt in Italy, and Europe in general, was in the courſe of time laid aſide and forgotten, and that the artichoke, when it was firſt brought to Italy from the Levant, was conſidered as a new ſpecies of food. It is undoubtedly certain that our artichoke was firſt known in that country in the 15th century. Hermolaus Barbarus, who died in 1494, relates that this plant was firſt ſeen at Venice in a garden in 1473, at which time it was very ſcarce *. About the year 1466, one of the family of Strozza brought the firſt artichokes to Florence from Naples †. Politian, in a letter in which he deſcribes the diſhes he found at a grand entertainment in Italy in 1488, among theſe men-

* Nondum irrepſit hoc ferculum Venetiis, una tantum ejus planta Mauriano vico cernitur in hortis Barbaricis. *Herm. Barbar. ad Dioſcor.* iii. 15. See Dioſcoridis libri viii, Ruellio interprete, cum H. Barbari corollariis et Vergilii annotationibus. Argentorati 1529. fol. p. 157.

† Philippus Matthæi Simonis Strozæ bene et ipſe de Florentina republica meritus, magnificæque Strozarum domus præ cæteris ædificator, carduum ſativum circa annum 1466 ex Neapoli primamque ficum, gentile vulgo appellatam, Florentiæ advexit. *Manni de Florentinis inventis commentarium*, p. 34. *Matthiolus*, in his Obſervations on Dioſcorides, iii. 14, ſays, Cardui noſtrates in Hetruriam ex Neapoli allati fuerunt; Neapolim vero (ut audio) ex Sicilia.

tions

tions artichokes *. They were introduced into France in the beginning of the ſixteenth century †; and into England in the reign of Henry the eighth ‡.

Reſpecting the origin of the name various conjectures have been formed, none of which, in my opinion, are founded even on probability. Hermolaus Barbarus, Henry Stephens, Ruellius, Hereſbach, and others think that *artichoke*, or *artichaut* as it is called by the French, and *arciocco* by the Italians, is derived from the Greek word *coccalus*, which ſignifies a fir-cone, with the Arabic article *al* prefixed, from which was formed *alcocalon*, and afterwards the name now uſed §. This etymology is contradicted by Saumaiſe ‖, who denies that *coccalus* had ever that ſignification. He remarks alſo that artichokes were by the Arabs called *harſaf*, *harxaf*, or *harchiaf*; and he ſeems not diſin-

* Carduus et ſcolymon, ſive cynaram potius appellare convenit. *Politiani Opera.* Lugduni 1533. 8vo. p. 444.

† Hoc memoria noſtra ferculum Gallis irrepſit. Nunc fere plurimæ hortorum arcæ hac ſtirpe pubeſcunt, ut nec jam ſine cibo hoc, niſi tempus anni neget, opipara vel aditialis ulla ſit cœna. *Ruellius de natura ſtirpium.* Baſiliæ 1543. fol. p. 485.

‡ The paſſage from Hakluyt, vol. ii. p. 164, which proves this, may be found in the *Biographia Britannica*, vol. iv. p. 2462, and in Anderſon's Hiſtory of commerce.

§ Ligures arcoccum vocant, quaſi alcoccalon; ut prima ejus verbi ſyllaba pro articulo ſit, quem Mauritani omnibus fere vocibus præponunt. *Hermolaus Barbarus*, in his Obſervations on Dioſcorides.

‖ Salmaſ. ad Solin. p. 160.

clined to derive the name from theſe appellations *. Grotius, Bodæus, and ſome others, derive it from a Greek word †, which occurs in Alexander Trallianus ‡, and which is ſuppoſed to ſignify our plant; but that word is to be found in this author alone, and in him only once; ſo that the idea of theſe critics appears to me very improbable. Friſch affirms, in his dictionary, that our modern name is formed from *carduus* and *ſcolymus* united. Ihre § conſiders the firſt part of the name as the German word *erde* (the earth), becauſe it is often pronounced *erdſchoke*; but I rather think that the Germans changed the foreign word *arti* into the word *erde*, which was known to them, in the ſame manner as of *tartuffolo* we have made *erdtoffeln* ||; beſides, Ihre leaves the latter part unexplained **.

* Ab illo Arabico *hærſchiaf* videndum an deſcenderit vulgaris appellatio cardi qui nobis artichau, aliis hercoccus. Pronuntiatione melius apparet ſimilitudo. *Salmaſii Exercitat. de homonymis hyles iatricæ.* Trajecti ad Rhenum 1689. fol. p. 77. It is remarked in Golius's Dictionary, p. 597, that this word ſignifies alſo the ſcales of a fiſh, and the ſtrong ſcales of the calyx of the plant may have given riſe to the name.

† The Greek word is αρτυτικη.

‡ Lib. vii. cap. 3. De curatione retentricis facultatis. In the Latin tranſlation in *Stephani Medicæ artis princip.* p. 221, the word *artytica* is retained.

§ Ihre, Gloſſarium Suiogothicum. Upſaliæ 1769. fol. i. p. 411.

|| Potatoes.

** A variety of derivations may be found collected in Dictionnaire étymologique de la langue Françoiſe, par M. Menage. See the laſt edition by Jault, Paris 1750, 2 vol. fol. i. p. 96.

In the laſt century the plant was often called *Welſch diſtel* (Italian thiſtle), becauſe the ſeeds were procured from Italy, and alſo *ſtrobeldorn* *, a word undoubtedly derived from *ſtrobilus*.

Were the original country of the artichoke really known, the etymology of the name, perhaps, might be eaſily explained. Linnæus ſays that it grew wild in Narbonne, Italy, and Sicily, and the cardoons in Crete; but, in my opinion, the information reſpecting the latter has been taken only from the above-quoted paſſage of Bellon, which is improperly ſuppoſed to allude to the artichoke. As far as I know, it was not found upon that iſland either by Tournefort or any other traveller. Garidel †, however, mentions the artichoke under the name given it by Bauhin, *cinara ſylveſtris latifolia*, among the plants growing wild in Provence; but later authors aſſure us that they ſought for it there in vain ‡. I ſhall here remark that the artichoke, as Saumaiſe § tells us, is certainly known in Perſia; but Tavernier ſays ex-

* Hereſbach de re ruſtica, lib. ii. p. 251.

† Hiſtoire des plantes qui naiſſent aux environs d'Aix. Par Garidel. A Aix 1715. fol. p. 111.

‡ Je l'ai cherché vainement dans les campagnes ſans l'y trouver. Quoique cette contrée éprouve peu de froid, il y gâle cependant, et ſon pied périt tout entier. Ce n'eſt pas la marche des plantes vivaces dans leur pays natal. *Cours complet d'agriculture*, par l'Abbé Rozier, vol. ii. p. 14.

§ De homonymis, p. 78.

preſsly that it was carried thither, like aſparagus and other European vegetables of the kitchen garden, by the Carmelite and other monks; and that it was only in latter times that it became common *.

SAW-MILLS.

IN early periods, the trunks of trees were ſplit with wedges into as many and as thin pieces as poſſible †; and if it was neceſſary to have them ſtill thinner, they were hewn on both ſides to the proper ſize. This ſimple and waſteful manner of making boards has been ſtill continued to the preſent time. Peter the Great of Ruſſia endeavoured to put a ſtop to it by forbidding hewn deals to be tranſported on the river Neva. The ſaw, however, though ſo convenient and beneficial, has not been able to banith entirely the practice of

* See his Travels. Geneva 1681, fol. p. 164.

† Nam primi cuneis ſcindebant fiſile lignum.

Virgil. Georg. lib i. v. 144.

Pontoppidan ſays, "Before the middle of the ſixteenth century all trunks were hewn and ſplit with the ax into two planks; whereas at preſent they would give ſeven or eight boards. This is ſtill done in ſome places where there are no ſaw-mills in the neighbourhood; eſpecially at Sudenoer and Amte Nordland, where a great many boats and ſloops are built of ſuch hewn boards, which are twice as ſtrong as thoſe ſawn; but they conſume too many trunks." See *Natürliche hiſtorie von Norwegen.* Copenhagen 1753, 2 vol. 8vo. i. p. 244.

ſplitting

ſplitting timber uſed in building, or in making furniture and utenſils, for I do not ſpeak here of fire wood; and, indeed, it muſt be allowed that this method is attended with peculiar advantages, which that of ſawing can never poſſeſs. The wood-ſplitters perform their work more expeditiouſly than ſawyers, and ſplit timber is much ſtronger than that which has been ſawn; for the fiſſure follows the grain of the wood, and leaves it whole; whereas the ſaw, which proceeds in the line chalked out for it, divides the fibres, and by theſe means leſſens its coheſion and ſolidity. Split timber, indeed, turns out often crooked and warped; but in many purpoſes to which it is applied this is not prejudicial; and theſe faults may ſometimes be amended. As the fibres however retain their natural length and direction, thin boards, particularly, can be bent much better. This is a great advantage in making pipe-ſtaves, or ſieve-frames, which require ſtill more art, and in forming various implements of the like kind.

Our common ſaw, which needs only to be guided by the hand of the workman, however ſimple it may be, was not known to the inhabitants of America when they had the misfortune to be ſubdued by the Europeans *. The inventor of this inſtrument has by the Greeks been inſerted in

* Hiſtoire des Incas, de Garcilaſſo de la Vega, traduite par J. Baudoin. Amſterd. 1715, 8vo. ii. p. 61, 62.

their

their mythology, with a place in which, among their gods, they honoured the greateſt benefactors of the earlieſt ages. By ſome he is called Talus, and by others Perdix. Pliny * alone aſcribes the invention to Dædalus; but Hardouin, in the paſſage where he does ſo, chooſes to read Talus rather than Dædalus. In my opinion, Pliny may have committed an error, as well as any of the moderns; and as one writer, at preſent, miſleads another, Seneca †, who gives the ſame inventor, may have fallen into a miſtake by copying Pliny. Diodorus Siculus ‡, Apollodorus §, and others name the inventor Talus. He was the ſon of Dædalus' ſiſter; and was by his mother placed under the tuition of her brother, to be inſtructed in his art. Having once found the jaw-bone of a ſnake, he employed

* Fabricam materiam invenit Dædalus, et in ea ferram. *Lib.* vi. 1. cap. 56.

† Quomodo oro te convenit, ut Diogenem mireris et Dædalum? Uter ex his ſapiens tibi videtur, qui ferram commentus eſt; an ille qui - - - - - - *Epiſt.* 90.

‡ Σιαγονι πέριτυχων οφεως και ταυτη ξυλιφιον μικρον διαπρισας, εμιμησατο την τραχυτητα των οδοντων. Διοπερ κατασκευασαμενος εκ σιδηρου πριονα, και δια τουτου πριζων την εν τοις εργοις ξυλινην ὑλην, εδοξεν ευχρηστον ευρηκεναι μετα προς την τεκτονικην τεχνην. Diodor. Sicul. lib. iv. cap. 78.

§ Apollodori Biblioth. lib. iii. cap. 16. edit. Heynii, i. p. 282: σιαγονα γὰρ οφεως ἑυρων, ξυλον λεπτον επρισε. Serpentis malam nactus, lignum tenue ſecuit. The name Ταλως, Talus, is by Pauſanias, lib. i. cap. 21. improperly written Καλως. See Heyne's annotations on the paſſage above quoted, and *Auctores mythographi Latini*, ed. Van Staveren, Lugd. Bat. 1742, 4to. p. 102.

it

it to cut through a ſmall piece of wood; and by theſe means was induced to form a like inſtrument of iron, that is, to make a ſaw. This invention, which greatly facilitates labour, excited the envy of his maſter, and inſtigated him to put Talus to death privately. We are told, that being aſked by ſome one, when he was burying the body, what he was depoſiting in the earth, he replied, A ſerpent. This ſuſpicious anſwer diſcovered the murder; and thus, adds the hiſtorian, a ſnake was the cauſe of the invention, of the murder, and of its being found out *.

Hyginus †, Servius ‡, Fulgentius §, Lactantius Placidus ||, Iſiodorus ¶, and others call the inventor

* Thoſe who are deſirous of ſeeing the whole account may conſult Diodorus, or Banier's Mythology.

† Dædalus Perdicem ſororis ſuæ filium propter artificii invidiam, quod is primum ferram invenerat, ſummo tecto dejecit. *Hygin. Fab.* 39. Dædalus Perdicem, ſororis ſuæ filium, propter artificii invidiam occidit. *Fab.* 244. Perdix, Dædali ſororis filius, ferram ex piſcis ſpina reperit. *Fab.* 274.

‡ Ad Georg. i. 143.

§ Mytholog. lib. iii. 2. p. 708, ed. Van Staveren: Perdix primus ferram invenit.

|| Dædalus in Siciliam, ſepulto filio, profugit. Cujus caſum Perdix Calai filius, Athenienſis, pro gaudio tulit. *Lactantii Placidi Argumenta metamorphoſeon Ovidii*, which may be found in the above quoted *Mythology*, and in Burmann's edition of Ovid, lib. viii. fab. 3.

¶ Serræ circinique uſum Perdices quidem adoleſcens invenit, quem puerum Dædalus, frater matris ſuæ, ſtudiis perdocendum acceperat. Cujus pueri tantum ingenium fertur, ut dum materiæ dividendæ compendium

tor Perdix. That he was the ſon of a ſiſter of Dædalus they all agree; but they differ reſpecting the name of his parents. The mother is by Fulgentius called Polycaſtes, but without any proof; and Lactantius gives to the father the name of Calaus. In Apollodorus, however, the mother of Talus is called Perdix; and the ſame name is given by Tzetzes to the mother of the inventor, whoſe name Talus he changes into Attalus*. Perdix, we are told, did not employ for a ſaw the jaw-bone of a ſnake, like Talus, but the back-bone of a fiſh; and this is confirmed by Ovid †, who, nevertheleſs, is ſilent reſpecting the name of the inventor.

What may be meant by *ſpina piſcis* it is perhaps difficult to conjecture; but I can by no means make *ſpina dorſi* of it, as Dion. Salvagnius has done, in his obſervations on the paſſage quoted from Ovid's Ibis. The ſmall bones which project from the ſpine of a fiſh *(apophyſes proceſſus)* have ſome ſimilitude to a ſaw; but it would be hardly poſſible to ſaw through with them ſmall

pendium quæreret, ſpinam piſcis imitatus de ferro laminam exaſperans dentium mordacitate armavit, quam ſerram artifices nuncupant. *Iſiodori Orig.* lib. xix. cap. 19.

* Chiliad. i. 493.

† Ille etiam medio ſpinas in piſce notatas
Traxit in exemplum: ferroque incidit acuto
Perpetuos dentes, et ſerræ reperit uſum.
Ovidii Metamorph. lib. viii. 244.

The following line from the Ibis, ver. 500, alludes to the ſame circumſtance:

Ut cui cauſa necis ſerra reperta fuit.

pieces

pieces of wood. Theſe bones are too long, as well as too far diſtant from each other; and the joints of the back-bone are liable to be diſlocated by the ſmalleſt force. I am not acquainted with the ſpine of any fiſh which would be ſufficiently ſtrong for that purpoſe. The jaw-bone of a fiſh furniſhed with teeth would be more proper; but the words *ſpina in medio piſce* prevent us from adopting that alteration. I ſhould be inclined rather to explain this difficulty by the bone which projects from the ſnout of the ſaw-fiſh, called by the Romans *ſerra*, and by the Greeks *priſtis*. That bone, indeed, might not be altogether unfit for ſuch an uſe: the teeth are ſtrongly united to the broad bone in the middle, and are capable of reſiſting a great force; but they are placed at rather too great a diſtance. The old inhabitants of Madeira, however, we are told, really uſed this bone inſtead of a ſaw *.—That Talus found the jaw-bone of a ſnake with teeth like a ſaw is extremely probable, for there are many ſnakes which have teeth of that kind.

The ſaws of the Grecian carpenters had the ſame form, and were made in the like ingenious manner as ours are at preſent. This is fully ſhewn by a painting ſtill preſerved among the antiquities

* See Cadomoſto's Voyage to Africa, in *Novus Orbis*, cap. 6. This account is not ſo ridiculous as that of Olaus Magnus, who ſays that the ſaw-fiſh can with his ſnout bore through a ſhip.

of

of Herculaneum *. Two genii are repreſented at the end of a bench, which conſiſts of a long table that reſts upon two four-footed ſtools †. The piece of wood which is to be ſawn through is ſecured by cramps. The ſaw with which the genii are at work has a perfect reſemblance to our frame ſaw. It conſiſts of a ſquare frame, having in the middle a blade, the teeth of which ſtand perpendicular to the plane of the frame. The piece of wood which is to be ſawn extends beyond the end of the bench, and one of the workmen appears ſtanding and the other ſitting on the ground. The arms, in which the blade is faſtened, have the ſame form as that given to them at preſent. In the bench are ſeen holes, in which the cramps that hold the timber are ſtuck. They are ſhaped like the figure ſeven; and the ends of them reach below the boards that form the top of it. The French call a cramp of this kind *un valet* ‡.

Mont-

* Rappreſenta l'altra pittura due Genii, ch' eſſercitano l'arte de' falegnami: ſon da oſſervarſi nella bottega gli arre di, la ſega, e 'l pancone col ferro uncinato per tenervi ferme le tavole da lavorarſi. Sotto al pancone evvi il martello, e una caſſetta, forſe per riporvi dentro gl' inſtrumenti dell' arte, come appunto ſoglion praticare i noſtri legnajuoli. Affiſſa al muro ſi vede una menſula con ſopra un vaſe, forſe con olio, per ungere i ferri. *Le Pitture antiche d'Ercolano*, tomo i. Napoli 1757, fol. tav. 34. p. 178.

† Almoſt in the ſame manner as in *L'art du Menuiſier, par Roubo*. par. 1. tab. 5. fig. 9.

‡ That cramps or hold-faſts are ſtill formed in the ſame manner as thoſe

Montfaucon * alſo has given the repreſentation of two ancient ſaws taken from Gruter. One of them ſeems to be only the blade of a ſaw without any frame; but the other figure I conſider as a croſs-cut ſaw; and I think I can diſtinguiſh all the parts, though it is imperfectly delineated. One may however perceive both the handles between which the blade is faſtened; the wooden bar that binds them together, though the blade is delineated too near it; and about the middle of this bar, the piece of wood that tightens the cord which keeps the handles as well as the whole inſtrument firm. Saws which were not placed in a frame, but faſtened to a handle, are thus deſcribed by Palladius †: Serrulæ manubriatæ minores majoreſque ad menſuram cubiti, quibus facile eſt, quod per ferram fieri non poteſt, reſecando trunco arboris, aut vitis interſeri.

The moſt beneficial and ingenious improvement of this inſtrument was, without doubt, the invention of ſaw-mills, which are driven either by water

thoſe ſeen in the ancient painting found at Herculaneum, particularly when fine inlaid works are made, is proved by the figure in *Roubo, l'Art du Menuiſier*. par. 1. p. 56. tab. xi. fig. 4. and tab. xii. fig. 15.

* L'antiquité expliquée et repreſentée en figures. Tome troiſieme. Paris 1719, fol. par. 2. pl. 189, pag. 341.

† Pallad. de re ruſt. lib. i. tit. 43.—Cicero in his oration for Cluentius, chap. lxiv. ſpeaks of an ingenious ſaw, with which a thief ſawed out the bottom of a cheſt.—Cum exſectio illa fundi in armario animadverteretur, quærebant homines, quonam modo fieri potuiſſet. Quidam ex amicis Saſſiæ recordatus eſt, ſe nuper in auctione quadam vidiſſe in rebus minutis aduncam ex omni parte dentium et tortuoſam venire ferrulam, qua illud potuiſſe ita circumſecari videretur.

or

or by the wind. Mills of the firſt kind were erected ſo early as the fourth century, in Germany, on the ſmall river Roer or Ruer *: for though Auſonius ſpeaks properly of water-mills for cutting ſtone, and not timber, it cannot be doubted that theſe were invented later than mills for manufacturing deals, or that both kinds were erected at the ſame time. The art, however, of cutting marble with a ſaw is very old. Pliny † conjectures that it was invented in Caria; at leaſt he knew no building incruſted with marble of greater antiquity than the palace of King Mauſolus, at Halicarnaſſus. This edifice is celebrated by Vitruvius ‡, for the

* - - - - - - - Ille (Erubrus)
Præcipiti torquens cerealia ſaxa rotatu,
Stridenteſque trahens per lævia marmora ſerras,
Audit perpetuos ripa ex utraque tumultus.
Auſonii Moſella, v. 361.

† Secandi marmor in cruſtas neſcio an Cariæ fuerit inventum. Antiquiſſima, quod equidem inveniam, Halicarnaſſii Mauſoli domus Proconneſio marmore exculta eſt, lateritiis parietibus. Is obiit Olympiadis cvi. anno ſecundo, urbis Romæ anno ccccliii. - - - - - - Sed quiſquis primum invenit ſecare, luxuriamque dividere, importuni ingenii fuit. Arena hoc fit, et ferro videtur fieri, ſerra in prætenui linea premente arenas, verſandoque tractu ipſo ſecante - - - - - Jam quidem quacunque arena ſecare e fluviis omnibus fraus artificum auſa eſt; quod diſpendium admodum pauci intelligunt. Craſſior enim arena laxioribus ſegmentis terit, et plus erodit marmoris, majuſque opus ſcabritia polituræ relinquit. *Plin.* lib. xxxvi. cap. 6.

‡ Item Halicarnaſſi, potentiſſimi regis Mauſoli domus cum Proconneſio marmore omnia haberet ornata, parietes habet latere ſtructos, qui ad hoc tempus egregiam præſtant firmitatem, ita tectoriis operibus expoliti, ut vitri perluciditatem videantur habere. *Vitruv.* lib. ii. cap. 8.

beauty

beauty of its marble; and Pliny gives an account of the different kinds of ſand uſed for cutting it; for it is the ſand properly, ſays he, and not the ſaw, which produces that effect. The latter preſſes down the former, and rubs it againſt the marble; and the coarſer the ſand is the longer will be the time required to poliſh the marble which has been cut by it. Stones of the ſoap-rock kind, which are indeed ſofter than marble, and which would require leſs force than wood, were ſawn at that period *: but it appears that the far harder glaſſy kinds of ſtone were ſawn then alſo; for we are told of the diſcovery of a building which was encruſted with cut agate, carnelian, lapis-lazuli, and amethyſts †. I have, however, found no account in any of the Greek or Roman writers of a mill for ſawing wood; and as the writers of modern times ſpeak of ſaw-mills as new and uncommon, it would ſeem that the oldeſt conſtruction of them

* In Belgica provincia candidum lapidem ſerra, qua lignum, faciliuſque etiam, ſecant, ad tegularem et imbricum vicem. *Plin.* lib. xxxvi. cap. 22.

† As a proof of this I can quote only the following paſſage, in Jannon de S. Laurent's treatiſe on the cut ſtones of the ancients, in *Saggi di diſſertazioni lette nella Academia Etruſca di Cortona*, tom. vi. Roma, 1751, 4to, p. 56. L'arte di ſegare i marmi facilmente fece arrivare gli antichi a ſegare pure le pietre più dure; lo che, ſenza andar a ricercar altro, trovò dimoſtrato da quello edificio antico ſcoperto nel tempo di Flaminio Vacca, il cui pavimento era compoſto di laſtre di agata e di carniola, ed altro di lapiſlazzali ed amatiſte veduto da Santi Bartoli. Ved. *Flam. Vac Mem. di var. antich.* n. 101. I conclude from *Fabricii Bibliograph. antiquar.* p. 27, that this book of Vacca was never printed.

has been forgotten, or that ſome important improvement has made them appear entirely new.

Becher ſays, with his uſual confidence, that ſaw-mills were invented in the ſeventeenth century *. Though this is certainly falſe, I did not expect to find that there were ſaw-mills in the neighbourhood of Augſburg, ſo early as the year 1337, as Mr. Stetten † has diſcovered by the town-books of that place. I ſhall here inſert his own words, in anſwer to a requeſt I made that he would be ſo kind as to communicate to me all the information he knew on that ſubject. "You are deſirous of reading that paſſage in our town-books, where ſaw-mills are firſt mentioned; but it is of very little importance. There is to be found only under the year 1338 the name of a burgher called *Giſs Saegemuller*; and though it may be objected that one cannot from the name infer the exiſtence of the employment, I am of a different opinion; eſpecially as I have lately been able to obtain a proof much more to be depended on. In the Surveyors' book, which I have often before quoted, and which, perhaps, for many centuries has not been ſeen or conſulted by any one, I find under the year 1322, and ſeveral times afterwards, ſums diſburſed under the following

* Saw-mills are uſeful machines, firſt introduced in this century; and I do not know any one who can properly be called the real inventor. *Närriſche weiſheit.* Frankf. 1683, 12mo, p. 78.

† In that excellent work, *Kunſt-und-handwerks geſchichte der Stadt Augſburg*, 1779, 8vo, p. 141.

title:

title: *Molitori dicto Hanrey pro asseribus et swaertlingis.* Schwartlings, among us, are the outside deals of the trunk, which, in other places, are called *Schwarten.* This word, therefore, makes the existence of a saw-mill pretty certain. As a confirmation of this idea, we have still a mill of that kind which is, at present, called the Hanrey-mill; and the stream which supplies it with water is called the Hanrey-brook. Since the earliest ages, the ground on which this mill, and the colour, stamping and oil mills in the neighbourhood, are built, was the property of the hospital of the Holy Ghost. By that hospital it was given as a life-rent to a rich burgher named Erlinger, but returned again in 1417 by his daughter Anna Bittingerin, who had, above and under the Hanrey-mill, two other saw-mills, which still exist, and for which, in virtue of an order of council of that year, she entered into a contract with the hospital in regard to the water and mill-dams."—There were saw-mills, therefore, at Augsburg so early as 1322. This appears to be highly probable also from this circumstance, that such mills occur very often in the following century in many other countries.

When the Infant Henry sent settlers to the island of Madeira, which was discovered in 1420, and caused European fruits of every kind to be carried thither, he ordered saw-mills to be erected also, for the purpose of sawing into deals the various species of excellent timber with which the island abounded,

and which were afterwards tranſported to Portugal *. About the year 1427 the city of Breſlau had a ſaw-mill which produced a yearly rent of three marks †; and in 1490 the magiſtrates of Erfurt purchaſed a foreſt, in which they cauſed a ſaw-mill to be erected, and they rented another mill in the neighbourhood beſides ‡. Norway, which is covered with foreſts, had the firſt ſaw-mill about the year 1530. This mode of manufacturing timber was called the new art; and becauſe the exportation of deals was by theſe means increaſed, that circumſtance gave occaſion to the deal-tythe, introduced by Chriſtian III in the year 1545 §. Soon after the celebrated Henry Canzau cauſed

* This we are told by Abraham Peritſol, the Jew, in *Itinera mundi*, printed with the learned annotations of Thomas Hyde, in *Ugolino, Theſaur. antiquitatum ſacrarum*, vol. vii. Venetiis 1747, fol. p. 103. Relictæ ſunt ibi arbores magnæ de lignis Gopher et lignis citrorum, ut ex eorum lignis uterentur ad conficiendum aſſeres et tabulas pulcerrimas et ciſtas, artificio ſerræ quæ ligna ſecat per vires curſus octo fluviorum minorum, quæ, inquam, ligna ſecant motu ſerræ; et ex iſtis tabulis et aſſeribus et plancis conficiunt ciſtas, et vaſa pulcra, quæ per viam mercaturæ advehuntur ad ſerviendum majori parti civitatum regni Portugalliæ, et particulariter Liſbonæ—Peritſol wrote before the year 1547.

† Von Breſlau dokumentirte geſchichte und beſchreibung. Breſlau 1781. 8vo, vol. ii. part 2, p. 409.

‡ Von Falkenſteins Hiſtorie von Erfurth. Erfurth 1739. 4to, p. 424.

§ Nicolaus Cragius, in his *Hiſtoria regis Chriſtiani III.* Hafniæ 1737, fol. p. 293, ſpeaking of the year 1545, ſays: In Norvegia hoc amplius novum inſtitutum, ut aſſerunt, qui ex ſilvis regiis ſerris reciderentur, decimum quemque, qui eo commodo fruerentur fiſco inferrent. Ea

cum

cauſed the firſt mill of this kind to be built in Holſtein *. In 1552 there was a ſaw-mill at Joachimsthal, which, as we are told, belonged to Jacob Geuſen, mathematician †. In the year 1555 the biſhop of Ely, ambaſſador from Mary queen of England to the court of Rome, having ſeen a ſaw-mill in the neighbourhood of Lyons, the writer of his travels thought it worthy of a particular deſcription ‡. In the ſixteenth century, however, there were mills with different ſaw-blades, by which a plank could be cut into ſeveral deals at the ſame

tum *nova ars* dicebatur, in Norvegiam, ubi ſuppetebat ſemper abunde materia, demum Friderici regis tempore introducta. Ac quia inde aucto ſtudio et induſtria hominum multum emolumenti incolis acceſſit, æquum viſum eſt, aliquam etiam utilitatem redundare ad fiſcum, quippe cujus erant ſilvæ quæ in hunc uſum cædebantur. —See alſo *Pontoppidans Natürliche hiſtorie von Norwegen*, erſter theil, Kopenhag. 1753, 8vo, p. 244; *Von Holbergs Beſchreibung der Stadt Bergen*, Kopenhag. 1753, 8vo, p. 42.

* Allgemeine Welthiſtorie, xxxiii. p. 227.

† So ſays Matheſius *in der Joachimsthaliſchen Chronik*.

‡ The account of this journey may be found in *Miſcellaneous State Papers, from* 1501 *to* 1726, London 1778, 4to. i. p. 71: "The ſaw-mill is driven with an upright wheel; and the water that maketh it go, is gathered whole into a narrow trough, which delivereth the ſame water to the wheels. This wheel hath a piece of timber put to the axle-tree end, like the handle of a broch, and faſtened to the end of the ſaw, which being turned with the force of the water, hoiſteth up and down the ſaw, that it continually eateth in, and the handle of the ſame is kept in a rigall of wood from ſwerving. Alſo the timber lieth as it were upon a ladder, which is brought by little and little to the ſaw with another vice.—This paſſage was pointed out to me by Profeſſor Sprengel of Halle.

time. Pighius ſaw one of theſe, in 1575, on the Danube, near Ratiſbon, when he accompanied Charles, prince of Juliers and Cleves, on his travels *. It may here be aſked whether the Dutch had ſuch mills firſt, as is commonly believed †. The firſt ſaw-mill was erected in Holland at Saardam, in the year 1596; and the invention of it is aſcribed to Cornelis Corneliſſen ‡; but he is as little the inventor, as the mathematician of Joachimsthal. Perhaps, he was the firſt perſon who built a ſaw-mill at that place, which is a village of great trade, and has ſtill a great many ſaw-mills, though the number of them is becoming daily leſs; for within the laſt thirty years a hundred have been given up §. The firſt mill of this kind in

* Lignariæ moletrinæ tunc oſtendebant, ut vaſti ponderis trabes, arbores etiam immenſæ, ſua ſponte ex undis exurgentes in tabulata ac pontes, ſeſe ſtridentibus ſubſilientium, ac multiplicium ferrarum dentibus ingerunt, atque in plures uno tractu brevi temporis ſpatio tabulas partiuntur. *Hercules Prodicus.* Coloniæ 1609, 8vo. p. 95.

† Leupolds und Beyers *Theatrum machinarum molarium.* Leipzig 1735, fol. p. 114. I ſhall here take occaſion to remark, that in the ſixteenth century there were boring-mills driven by water. Felix Fabri, in his *Hiſtoria Suevorum*, p. 81, ſays, that there were ſuch mills at Ulm: Ibi trabes magnæ perforantur aquæ motu.

‡ De zaag-moolens zyn door eenen Cornelis Corneliſſen van Uytgeeſt in den jare 1592 uytgevonden, die de eerſte in den jare 1596 op Saanerdam heeft gebracht, de welke om deſſelfs gedaante het Juffertjen wierdt genaant, waar van de ſtandt-plaats noch in gedachtenis wordt gehouden. *De koophandel van Amſterdam.* Amſterdam 1727, vol. ii. p. 583.

§ La richeſſe de la Hollande. A Londres 1778, 4to, i. p. 259.

Sweden was erected in the year 1653 *. At preſent, that kingdom poſſeſſes the largeſt perhaps ever conſtructed in Europe, where a water-wheel, twelve feet broad, drives at the ſame time ſeventy-two ſaws †.

In England ſaw-mills had at firſt the ſame fate that printing had in Turkey, the ribbon-loom in the dominions of the Church, and the crane at Straſburgh. When attempts were made to introduce them they were violently oppoſed, becauſe it was apprehended that the ſawyers would be deprived by them of their means of getting a ſubſiſtence. For this reaſon, it was found neceſſary to abandon a ſaw-mill erected by a Dutchman near London ‡, in 1663; and in the year 1700, when one Houghton laid before the nation the advantages of ſuch a mill, he expreſſed his apprehenſion that it might excite the rage of the populace §. What he dreaded was actually the caſe in 1767 or 1768, when an opulent timber-merchant, by the deſire and approbation of the Society of Arts, cauſed a ſaw-mill, driven by wind, to be erected at Limehouſe under the direction of James Stansfield, who had learned, in Holland and Norway, the art of con-

* We are told ſo by Joh. Claſon in his academical diſcourſe *om Sweriges handels omſkiften* 1751.

† See Profeſſor Buſch, Reiſe durch Schweden, p. 14.

‡ Anderſon's Hiſtory of commerce, vol. v.

§ Huſbandry and trade improved, by John Houghton. London 1727, vo. iii. p. 47.

ſtructing and managing machines of that kind. A mob aſſembled, and pulled the mill to pieces; but the damage was made good by the nation, and ſome of the rioters were puniſhed. A new mill was afterwards erected, which was ſuffered to work without moleſtation, and which gave occaſion to the erection of others *. It appears, however, that this was not the only mill of the kind then in Britain; for one driven alſo by wind had been built at Leith, in Scotland, ſome years before †.

STAMPED PAPER.

PAPER ſtamped with a certain mark by Government, and which in many countries muſt be uſed for all judicial acts, public deeds, and private contracts, in order to give them validity, is one of thoſe numerous modes of taxation invented after the other means of raiſing money for the ſervice of ſtates, or rather of their rulers, became exhauſted. It is not of great antiquity; for before the invention of

* Memoirs of agriculture and other œconomical arts, by Robert Doſſie. London 1768, 8vo. i. p. 123. Of Stansfield's mill, on which he made ſome improvements, a deſcription and figure may be ſeen in the Advancement of arts, manufactures, and commerce, by William Bailey. London 1772, 4to. i. p. 231.

† Anderſon ut ſupra.

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our paper it would not have been a very productive ſource of finance. When parchment and other ſubſtances employed for writing on were dear; when greater ſimplicity of manners produced more honeſty and more confidence among mankind; and when tallies ſupplied the place of notes, bonds and receipts, writings of that kind were very little in uſe.

De Baſville or Baville, however, in his *Mémoires pour ſervir à l'hiſtoire de Languedoc*, affirms that ſtamped paper was introduced ſo early as the year 537, by the emperor Juſtinian. This book, written by the author, intendant of that province in 1697, for the uſe of the duke of Burgundy, was printed, in octavo, at Marſeilles in 1734, and not at Amſterdam, as announced in the title; but it was carefully ſuppreſſed by the Government, and on that account is very ſcarce even in France *. I have never ſeen it; but I know the author's ideas reſpecting ſtamped paper, from an extract in *Varietés hiſtoriques, phyſiques et litteraires*, printed at Paris in the year 1752 †. The author of this work ſupports the opinion of his countryman: but it is undoubtedly falſe; for the law quoted as a proof requires only that docu-

* An account of this book may be found in *Anecdotes ſecret. ſur divers ſujets de litterat.* 1734, p. 573. and in the preface to *Etat de la France, de M. de Boulainvilliers*, fol. p. 12.

† An extract from it is inſerted alſo in the Paris edition of the *Encyclopédie*, vol. xi. p. 862.

ments

ments ſhould be written on ſuch paper as had marked at the top (which was called the protocoll) the name of the intendant of the finances, and the time when the paper was made; and this regulation was eſtabliſhed merely with a view to prevent the forging and altering of acts or deeds *. A kind of ſtamped paper therefore was brought into uſe, though different from what we have at preſent, the principal intention of which is not to render writings more ſecure, but by impoſing a certain duty on the ſtamps, proportioned to the importance of the purpoſe it is employed for, to make a conſiderable addition to the public revenue †. The ſtamps

* Illud quoque præſenti adjicimus legi, ut tabelliones non in alia charta pura ſcribant documenta, niſi in illa quæ in initio (quod vocatur protocollum) per tempora glorioſiſſimi comitis ſacrarum noſtrarum largitionum habeat appellationem, et tempus quo charta facta eſt, et quæcunque in talibus ſcribuntur; et ut protocollum non incidant, ſed inſertum relinquant; novimus enim multas falſitates ex talibus chartis oſtenſas et prius et nunc; ideoque, licet aliqua ſit charta (nam et hoc ſancimus) habens protocollum non ita conſcriptum, ſed aliam quandam ſcripturam gerens, neque illam ſuſcipiant, tanquam adulteram, et ad talia non opportunam, ſed in ſola tali charta qualem dudum diximus documenta ſcribant. Hæc itaque quæ de qualitate talium chartarum a nobis decreta ſunt, et de inciſione eorum quæ vocantur protocolla, valere in hac feliciſſima ſolum civitate volumus, ubi plurima quidem contrahentium multitudo, multa quoque chartarum abundantia eſt, et licet legali modo intereſſe negotiis, et non dare occaſionem quibuſdam falſitatem committere, cui ſe obnoxios exiſtere demonſtrabunt qui præter hæc aliquid agere præſumpſerint. *Novell.* coll. iv. tit. 23. cap. 2. nov. 44.

† Such is the idea of Stryk in *Continuat. altera uſus moderni pandectarum*, lib. xxii. tit. 4. p. 356: Chartæ ſignatæ hodiernæ eſt longe alius finis, et potiſſimum ad augendum fiſcum inventa eſt.

ſerve

ſerve as a receipt to ſhew that the tax has been paid; and, though many law papers muſt be ſtamped, that burthen has tended as little to prevent law-ſuits as the ſtamping of cards has to leſſen gaming: though ſome think differently. In both too much is riſked and too much expected for taxes to deter mankind from engaging in either.

If in this hiſtorical reſearch, we look only to the antiquity of ſtamping, we ſhall find that both the Greeks and the Romans had ſoldiers marked in that manner; and, if we may be allowed to bring together things ſo different, we might include under the like head thoſe run-away ſlaves who were marked by being branded; but I allude here only to the ſtamped paper now in uſe, which was certainly invented in Holland, a country where every neceſſary of life is ſubjected to taxation. The States of the United Provinces having promiſed a reward to any one who ſhould invent a new impoſt, that might at the ſame time bear light on the people and be productive to the government, ſome perſon propoſed that of *bezegeld brieven*, or ſtamped paper, which was approved; and which Boxhorn, to whom we are indebted for this information, conſiders as a very proper tax. He is of opinion alſo that it might with great advantage be adopted in other countries*; and this was really

* The States of Holland having laid ſufficiently heavy duties on merchandiſe of every kind, and theſe not being equal to the expenditure, which

really the caſe ſoon after his death, which happened in 1653.

Stamped paper was introduced in Holland on the 13th of Auguſt 1624, by an ordinance which repreſented the neceſſity and great benefit of this new tax. Among other things advanced in its favour, it was ſaid, that it would tend to leſſen lawſuits, and, on that account, would ſoon recommend itſelf to neighbouring nations. What we are told, therefore, by the author of an extract in *Varietés hiſtoriques*,

which was daily increaſing, began to think of impoſing new ones. For that purpoſe they iſſued an edict, inviting the ingenious to turn their thoughts towards that ſubject, and offering a very ample reward to whoever ſhould invent a new tax, that might be as little burdenſome as poſſible, and yet productive to the republic. Some ſhrewd, deep-thinking perſon, at length, deviſed one on ſtamped paper (called *de impoſt van bezegelde brieven)*, to be paid for all paper impreſſed with the ſeal of the States. The inventor propoſed, that it ſhould be enacted by public authority, that no petitions from the ſtates, or from the magiſtrates of any city or diſtrict, or any public bodies, ſhould be received; that no documents ſhould be admitted in courts of juſtice; that no receipts ſhould be legal, and that no acts ſigned by notaries, ſecretaries, or other perſons in office, and, in ſhort, no contracts ſhould be valid, except ſuch as were written upon paper to which the ſeal of the States had been affixed, in the manner above mentioned. It was propoſed, alſo, that this paper ſhould be ſold by the clerks of the different towns, and courts, at the following rate: paper impreſſed with the great ſeal of the States for ſixpence, and that with the leſs ſeal for twopence per ſheet: for according to the importance of the buſineſs it was neceſſary that the great or leſs ſeal ſhould be uſed - - - - The States approved this plan, and it was immediately put in execution. *Boxhornii Diſquiſitiones politic.* caſus 59. Theſe *Diſquiſitiones politicæ* were printed by the author only for the uſe of his ſcholars, and publiſhed, at firſt, without his name. They are to be found, however, in *Box-*

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hiſtoriques, before quoted, that ſtamped paper began to be uſed in Holland and Spain ſo early as the year 1555, is certainly falſe. The Spaniards may, indeed, have been the firſt people who followed the example of the Dutch; for the author above mentioned aſſerts, that he ſaw an act, executed by a notary at Bruſſels, in 1668, which was written on ſtamped paper.

This tax was introduced in the electorate of Saxony by an ordinance of the 22d of March 1682; and into that of Brandenburg on the 15th of July the

[*bornii Varii tractatus politici*. Amſtelodami 1663, 12mo. In this collection there is alſo *Boxbornii Reip. Bataviæ brevis et accurata deſcriptio*, in the eighth chapter of which the author gives the following account of the origin of ſtamped paper: "A very ingenious method has lately been invented of raiſing large ſums of money for the uſe of the republic. As there are many rich people who have entruſted a conſiderable ſhare of their property to the public treaſury, the intereſt of which they receive annually on giving receipts; as many law-ſuits are carried on which are generally entered into by the wealthy, and which cannot be brought to a concluſion until a variety of inſtruments, as they are called, have been executed on each ſide; and as, on account of the flouriſhing ſtate of trade, many contracts are made, which, for the ſake of ſecurity, muſt be mutually ſigned, the States thought proper to enact, by a public edict, that no receipts, law-papers, contracts, or inſtruments of the like kind, ſhould be legal or valid, unleſs written on paper impreſſed with the great or ſmall ſeal of the States. A price was alſo fixed on the paper, to be paid by thoſe who had occaſion for it; ſo that a ſheet which before could be purchaſed for a halfpenny, was raiſed to ſeveral pence; and it is incredible how great a revenue theſe ſheets bring to the public, by ſo many of them being uſed. The poor, however, and thoſe of ſmall fortune, feel little of this burden, as the rich principally are concerned in the tranſactions above mentioned."

ſame year *. Bartholdus however ſays, but without producing any proof †, that ſtamped paper was uſed before that period in Denmark, Florence and Sileſia. In Hanover it was firſt introduced, as I think, on the 20th of February 1709.

INSURANCE.

INSURANCE, that excellent eſtabliſhment by which loſſes that would entirely ruin a merchant, being divided among a company, are rendered ſupportable, and almoſt imperceptible; by which undertakings too great for one perſon are eaſily accompliſhed, and by which commodities brought from the moſt diſtant regions are made cheaper ‡, appears not to have been known to the Romans, however near they may have come to the invention of it. If we examine cloſely the information from which ſome endeavour to prove the contrary,

* Mylii Corpus conſtitut. March. p. iv. ſect. 5. cap. 3. Von Dreyhaupts Beſchreibung des Saal-Kreiſes, im auſzuge, ii. p. 391. G. F. Mullers Stempel-recht. Halle 1778. 8vo. p. 9.

† Fr. Jac. Bartholdi Diſſ. de charta ſignata; reſp. P. Kolhart. Francof. ad Viadr. 1690. cap. 2, § 16, p. 36.

‡ As the Turks are unacquainted with inſurance, they do not lend money but at the rate of fifteen or twenty per cent. When they lend to merchants who trade by ſea, they charge thirty per cent. See *Remarques d'un voyageur moderne au Levant.* Amſterdam 1773. 8vo.

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it will be found that it is far from ſufficient to ſupport their opinion.

Puffendorf*, Barbeyrac †, Loccenius ‡, Kulpis §, and others ground their aſſertions on a paſſage of Livy ||, who ſays, that when the Roman army in Spain was diſtreſſed for proviſions, clothing, and other neceſſaries, a company engaged to convey to them every thing they ſtood in need of, under this ſtipulation, *ut quæ in naves impoſuiſſent, ab hoſtium tempeſtatiſque vi publico periculo eſſent*; that is, that the State ſhould make good their loſs, in caſe their veſſels ſhould be ſhipwrecked by ſtorms, or be taken by the enemy; and we are told that theſe terms were agreed to. This was, undoubtedly, a promiſe of indemnification, but by no means an inſurance, in which a premium is always neceſſary to be given. On occaſions of this kind, however, acts of fraud were practiſed, like thoſe committed at preſent, to the prejudice of inſurers. Shipwrecks were pretended to have happened which never took place; and old ſhattered veſſels, freighted with articles of little value, were purpoſely ſunk, and the crew ſaved in boats; and

* Puffendorfii de jure naturæ et gentium libri, cum annotationibus Hertii. Francofurti ad Mœn. 1706. 4to. p. 725.

† Le droit de la nature. A Baſle 1732. 2 vol. 4to. ii. p. 92.

‡ Loccenius de jure maritimo. Holmiæ 1650. 12mo. p. 151.

§ J. G. de Kulpis, Collegium Grotianum, edit. quinta Francofurti et Lipſiæ 1722, 4to. p. 84. Compare, Schele, Diſſert. de inſtrumento aſſecurationis, vulgo *polizza*, præſ. Werlhofio. Helmſtadii 1707.

|| Livius, lib. xxiii. cap. 44.

large

large ſums were then demanded, as a recompenſe for the loſs *.

Little more is proved by a paſſage of Suetonius †, which Kulpis and others conſider as affording an inſtance of inſurance. That author tells us, that the emperor Claudius promiſed to indemnify merchants for their loſſes, if their ſhips ſhould periſh by ſtorms at ſea. This paſſage Anderſon ‡ muſt not have read; elſe he would not have ſaid that Suetonius aſcribed the invention of inſurance to Claudius; and Kulpis ſeems not to have ſearched Valerius Maximus, otherwiſe he would not have quoted the fifth chapter of the ſixth book, which contains nothing that can be applied to inſurance.

In Simon's edition of *Grotius de jure belli et pacis* § a paſſage is quoted from Cicero's epiſtles ‖ as an inſtance of inſurance among the Romans, which ſeems to be more probable. Cicero ſays he hopes to find at Laodicea ſecurity, by means of

* Liv. lib. xxv. cap. 3.

† Nam et negotiatoribus certa lucra propoſuit, ſuſcepto in ſe damno, ſi cui quid per tempeſtates accidiſſet. Lib. v. cap. 18. Langenbec in his *Anmerkungen über das Hamburgiſche Schiff-und-ſee-recht*, p. 370, is of opinion that no traces of inſurance are to be found either in Livy or Suetonius.

‡ Hiſtory of commerce.

§ Jenæ 1673. 4to. p. 375.

‖ Laodiceæ me prædes accepturum arbitror omnis pecuniæ publicæ, ut et mihi et populo cautum ſit ſine vecturæ periculo. *Epiſt. ad famil.* ii. ep. 17.

which

which he can remit the money of the republic, without being expoſed to any danger on its paſſage. The word *prædes* may here ſignify inſurers; but, in my opinion, this paſſage ought rather to be claſſed among thoſe which have been collected by Ayrer, as the firſt traces of bills of exchange *.

Thoſe remains of the ancient laws which, according to Kulpis and others, allude to inſurance, concern bottomry *(fœnus nauticum)* only; and that this is much older than inſurance has been already fully proved by Stypman †.

Molynes ‡, Anderſon, and o thers affirm, that inſurance is mentioned in the marine laws of the Iſle of Oleron. This iſland, which lies oppoſite to the mouth of the Charente, on the coaſt of France, was much celebrated in the eleventh, twelfth, and following centuries, on account of its trade §. It belonged then to the duke of Aquitaine, and came to the crown of England by the marriage of Eleonora, daughter of the laſt duke, with Henry II. Under Eleonora were framed in the iſland thoſe laws ſo well known by the names

* Ayreri Diatribe de cambialis inſtituti veſtigiis apud Romanos, added to Uhle's edition of *Heineccii Elementa juris cambialis.*

† Stypmanni Tractatus de jure maritimo et nautico. Gryphiſwaldiæ 1652. par. iv. p. 19.

‡ Conſuetudo vel lex mercatoria, or the aneient law-merchant, by Gerard Molynes. London 1656. fol. p. 105.

§ This iſland may be found in the map entitled *Inſulæ divi Martini et Uliarus*, Amſtelod. apud Joan. Janſſon; and in Seutter's map, *Les environs de Rochelle.*

Roole d'Oleron, *Roole des jugemens d'Oleron*, that, like the laws of the Rhodians, they were uſed alſo by foreigners. Theſe laws were afterwards enlarged and improved by Richard I, Eleonora's ſon; at leaſt we are aſſured ſo by the French hiſtorians; but the Engliſh aſcribe them to Richard alone. In order to determine the period when they were framed, I ſhall only obſerve that Eleonora died in the year 1202, and Richard in 1199; and Anderſon, therefore, not without probability, places the origin of them in the year 1194. A copy of theſe laws, printed at Rouen, is ſtill preſerved, in which it is ſaid that they were firſt drawn up in 1266. This, however, the French and the Engliſh declare to be falſe *. They are written in French, but in the old Gaſcon dialect. I am acquainted with them from the following ſcarce book, the author of which, in the preface, calls himſelf Cleirac: *Us et coutumes de la mer* †; but I find no traces in them of inſurance. Even Cleirac himſelf ſeems not to have found any; for where he relates every

* Seldeni Mare clauſum, ſeu de dominio maris. Londini 1636. 8vo. p. 428.

† Bourdeaux 1661. 4to. p. 1. Reſpecting this book, and all the old maritime laws, there is an excellent account in *Brevis introductio in notitiam legum nauticarum, et ſcriptorum juris reique maritimæ*. Lubecæ 1713, 8vo. Struve ſays, in his *Bibliotheca juris ſelecta*, p. 119, that the learned author was a Dr. Andreas Lang, at Lubec. It is much to be wiſhed that ſome one would cauſe the laws of Oleron to be again printed, illuſtrated and compared with thoſe which at preſent reſemble them.

thing

thing he knew reſpecting the hiſtory of it, he aſcribes this invention, without mentioning the laws of Oleron, of which he has given an excellent explanation, as we do that of bills of exchange, to the Jews, who made uſe of it when they were expelled from France. According to Cleirac, inſurance was long deteſted by the Chriſtians, who at that time conſidered it as a ſin to take intereſt; and the uſe of it, as well as of bills of exchange, was firſt made common by the Guelphs and Ghibelines. Of this pretended ſervice of the Jews, in regard to inſurance, I know no proof.

The celebrated maritime laws of the city of Wiſby, in the iſland of Gothland *, whether of later date, as the French aſſert, or older, which is more probable, than thoſe of Oleron, are equally ſilent with reſpect to inſurance. Theſe laws were not written originally in Swediſh, as l'Eſtocq † ſays, but in the Low-German. The tranſlation into High-German by Marquard ‡ is incorrect, and the French one of Cleirac § is too free and too much abridged. The Dutch tranſlation publiſhed at Amſterdam is the completeſt ||.

* Lang, p. 35.

† Aufzug der hiſtorie des algemeinen und Preuſſiſchen ſee-rechts. Konigſberg 1747, 4to. p. 32.

‡ De jure mercatorum et commerciorum.

§ Page 165.

|| Entitled, 'T boek der zee-rechten, inhoudende dat hoochſte ende oudſte Godtlandtſche water-recht. Amſterdam 1664, 4to. p. 2.

Inſurance was, undoubtedly, not known at the time when the later Hanſeatic maritime laws were framed, elſe it would have been mentioned in them. Of theſe laws there are various editions. One of thoſe moſt uſed is that by Kuricke, which is inſerted alſo in *Heineccii Scriptorum de jure nautico et maritimo faſciculus.* Cleirac has given a French tranſlation of them.

As little reſpecting inſurance is to be found in *Il conſolato del mare* *. Theſe maritime laws, highly worthy of notice, were originally written in the Catalonian dialect; and it ſeems very probable that they were drawn up at Barcelona. A part of them appears to have been framed in the eleventh, but the greater part in the thirteenth century; for the book itſelf proves, in more than one place, that they are not all of the ſame antiquity. The moſt correct edition is that publiſhed at Leyden in 1704. Thoſe writers who have pretended that inſurance is mentioned in theſe Catalonian maritime laws have, perhaps, been led into this error, becauſe, in an appendix to ſome of the common editions, there is a ſhort account of inſurance as once

* The title runs thus: *Il conſolato del mare, nel quale ſi comprendono tutti gli ſtatuti et ordini, diſpoſti da gli antichi per ogni coſa di mercantia et di navigare.* Leyden 1704. 4to. To the other editions mentioned by Lange, p. 50, may be added that printed in *J. L. M. de Caſaregis Diſcurſus legales de commercio.* Florentiæ 1719. fol. It is the original, with Italian notes, but it is ſomewhat different from that of Weſterveen.

practiſed

practiſed at Barcelona *. As I have never ſeen this ſmall treatiſe, I do not know whether it contains any thing reſpecting the hiſtory of it. The oldeſt laws and regulations concerning inſurance, with which I am at preſent acquainted, are the following.

On the 28th of January 1523, five perſons appointed for that purpoſe drew up at Florence ſome articles which are ſtill employed on the exchange at Leghorn. Theſe important regulations, together with the preſcribed form of policies, which may be conſidered as the oldeſt †, have been inſerted, in Italian and German, by Magens, in his Treatiſe on inſurance, average and bottomry ‡, publiſhed at Hamburgh in 1753. I ſhould have been glad to have found in Italian authors ſome information reſpecting the antiquity of theſe regulations §, a copy of which Magens ſays he procured from Leghorn; but I have hitherto ſought

* Lang, p. 32.

† In that old treatiſe, *Le Guidon*, inſerted in Cleirac, it is remarked, chap. i. art. i. that, in old times, inſurances were made without any writings: they were then called *Aſſecurances en confiance*; Confidential inſurances.

‡ Verſuche über aſſecuranzen, havereyen und bodmereyen. Hamburg 1753. 4to. p. 367.

§ I found nothing on the ſubject, either in *Della decima—e della mercatura de' Fiorentini, fino al ſecolo* xvi. Liſbona e Lucca 1765, 1766. 4 vol. 4to. which contains a variety of uſeful information reſpecting the hiſtory of the Florentine trade, or in *Mecatti, Storia chronologica della citta di Firenze.* In Napoli 1775, 2 vol. 4to.

for it in vain. Straccha, however, mentions a Florentine order of June the 15th, 1526, which forbids common insurance, unless the goods and commodities are specified *,

There is still preserved a short regulation of the 25th May 1537, by the emperor Charles V, respecting bills of exchange and insurance, in which the strictly fulfilling only of an agreement of insurance is commanded.

In 1549 the same emperor issued an express order, *Op 't faict van der zee-vaerdt*, in which occur some articles respecting insurance †, and additions were afterwards made to it in 1561.

In the year 1556, Philip II, king of Spain, gave to the Spanish merchants certain regulations respecting insurance, which are inserted by Magens, with a German translation, in his work before mentioned. They contain some forms of policies on ships going to the Indies.

On the last of October 1563, Philip II published his maritime laws, in which some forms of policies are given ‡; but on the last of March 1568 that prince forbade the practice of insurance, on

* Stracchæ aliorumque juris consultorum de cambiis, sponsionibus, &c. decisiones et tractatus. Amstelodami 1669. fol. In Tractatus de assecurationibus, p. 24.

† It may be found in *Ordonantien ende placaeten ghepubliccert in Vlaenderen*. T'Antwerpen 1662, fol. i. p. 360.

‡ Ordonantien ende placcaeten ii. p. 307. Groote Placaet-boeck der Vereenighde Nederlanden, i. p. 796. Magens, p. 397.

account

account of the bad uſe to which it had been often applied. This prohibition I have not been able to find. I am acquainted with it only by an order of the 20th of January 1570, in which the king expreſsly recalls it, becauſe the merchants at Antwerp, both ſubjects and foreigners, had preſented ſtrong remonſtrances againſt it *.

In the year 1598, the *Kamer von aſſurantie*, Chamber of Inſurance, was eſtabliſhed at Amſterdam. An account of the firſt regulations of this inſurance-office may be ſeen in Pontanus's Hiſtory of the city of Amſterdam, and in other works †.

In the year 1600, regulations reſpecting inſurance were formed by the city of Middelburg in Zealand ‡.

It appears that the firſt regulations reſpecting inſurances in England, which may be ſeen in Anderſon's Hiſtory of commerce, were made in the year 1601. We find by them, that inſurers had before that period conducted themſelves in ſuch a manner, that the utmoſt confidence was repoſed in their

* Ordonantien ende placcaeten, ut ſupra, p. 335. Groote Placaetboeck, i. p. 828, and in the additions, ii p. 2116.

† J. J. Pontani Rerum et urbis Amſtelodamenſium hiſtoria. Amſterdam 1611. fol. p. 255. J. le Long, Koophandel van Amſterdam. Rotterdam 1780, 3 vol. 8vo. i. p. 47. The changes which this inſtitution afterwards underwent, with an extract from its regulations, may be ſeen in *La richeſſe de la Hollande*. A Londres 1778. 4to. i. p. 81.

‡ Groote Placaet-boeck, i. p. 867.

honeſty, and that on this account few or no diſputes had ariſen.

In the year 1604 regulations were formed reſpecting inſurance at Rotterdam *; and in 1610 were drawn up thoſe of Genoa, which Magens has inſerted in his work, taken from the Latin ſtatutes of the Republic, together with a German tranſlation †.

In 1612 the Inſurance Chamber at Amſterdam was eſtabliſhed by public authority, and received ſeveral privileges ‡.

Molynes aſſerts §, but without either proofs or probability, that the people of Antwerp were firſt taught inſurance by the Engliſh; and ſays that, as the merchants aſſembled for tranſacting buſineſs in Lombard-ſtreet, ſo called becauſe certain Italians from Lombardy had *lombards* there, or houſes for lending money on pledges, long before the building of the Exchange, it became cuſtomary, as it was in his time (1622), to be guided in policies by what was done in Lombard-ſtreet, in London.

Guicciardini, who wrote his Account of the Netherlands in 1567, remarks, in deſcribing Antwerp ‖, that the merchants there were accuſtomed

* See Groote Placaet-boeck, i. p. 859.

† Page 503 and 512.

‡ Groote Placaet-boeck, ut ſupra, p. 843.

§ Page 105.

‖ Guicciardini, Deſcrittione di tutti Paeſi Baſſi. In Anverſa 1567. fol. p. 126.

to

to insure their ships. Anderson says, which is very astonishing, as he thinks the invention of insurance is to be found in Suetonius, and in the laws of the Isle of Oleron, that this is the first instance of maritime insurance.

A most useful imitation of insurance in trade is the institution of insurance-offices, to indemnify losses sustained by fire. As far as I have been able to learn, companies for that purpose were first formed towards the middle of the present century, though houses were insured by individuals much earlier. The fire-office at Paris * was established in 1745; that of the electorate of Hanover in 1750; that of Nassau-Weilburg in 1751; those of Brunswick-Wolfenbuttel and Wirtemberg † in 1753; that of Anspach in 1754; that of Baden-Durlach in 1758; that of the county of Mark in 1764; those of Saxe-Weymar and Eisenach in 1768; and that of the Society of the Clergy in the Mark of Brandenburg ‡, to insure goods and household-furniture, was established in 1769.

It is perhaps known to few, that even in the beginning of the seventeenth century, a proposal was made by some ingenious person, that all the pro-

* Journal œconomique, 1758. Fevr. p. 70.

† Weissers Nachricht von den gesetzen des Herzogthums Wirtemberg. Stutgart 1781. 8vo. p. 39.

‡ Krunitz, Oekonomische encyclopedie, xiii. p. 221: where an account may be found of other companies.

prietors

prietors of land ſhould inſure the houſes of their ſubjects againſt fire, on their paying ſo much per cent. annually, according to the value of them. The author of this ſcheme preſented it to count Anthony Gunther von Oldenburg, in the year 1609, as a means of finance not to be found in any work printed on that ſubject. The author in his plan ſaid *, that "as many fires happened by which a great number of people loſt their property, the count might lay before his ſubjects the danger of ſuch accidents; and propoſe to them, that if they would, either ſingly or united, put a value on their houſes, and for every hundred dollars valuation pay to him yearly one dollar; he, on the other hand, would engage, that in caſe by the will of God their houſes ſhould be reduced to aſhes, the misfortunes of war excepted, he would take upon himſelf the loſs, and pay to the ſufferers as much money as might be ſufficient to rebuild them; and that all perſons, both natives and foreigners, who might be deſirous of ſharing in the benefits of this inſtitution ſhould not be excluded. The author was confident that, though the damage might fall heavy at firſt, a conſiderable ſum would be gradually raiſed, from year to year; and that every one might thus inſure his houſes againſt accidents. He had no doubt that it would be fully proved, if a calculation were made of the number

* This account is taken from *J. J. Winkelmanns Oldenburgiſchen friedens- und der benachbarten örter kriegshandlungen.* 1671., fol. p. 67.

of houſes conſumed by fire, within a certain ſpace, in the courſe of thirty years, that the loſs would not amount, by a good deal, to the ſum that would be collected in that time. He did not, however, adviſe that all the houſes in every town ſhould be comprehended, as the money claimed might amount to too much; but only that ſome and certain houſes ſhould be admitted into this aſſociation."

I ſhall here inſert, from the ſame author, the count's reflections on this plan, and the concluſion which he formed. "It is to be conſidered," ſays he, "what ſum every proprietor of land may with certainty raiſe and receive; whether the propoſed plan can, to the undoubted benefit of the ſubjects, and the advantage of their lord, be honourably, juſtly, and irreproachfully inſtituted without tempting Providence; without incurring the cenſure of neighbours; and without diſgracing one's name and dignity. In the next place, that this inſtitution may not have the appearance of a ſcheme to bring money into the country; and ſtill more that it may have no reſemblance to a duty, tax, or impoſt, but rather to a free contribution, or unconſtrained remuneration for being inſured from danger, and by which loſſes being made good, houſes can be ſooner rebuilt, and put in their former condition." The count allowed that the object of the plan was good, conſidered in every point of view, and that a company compoſed of common individuals might be formed

formed to inſure each other's houſes, and pay the loſſes ſuſtained by fire: but he concluded, that, if he undertook the plan, Providence might be tempted; that his own ſubjects might be diſpleaſed; and that, improper ideas being formed of his conduct, he might be accuſed unjuſtly of avarice. "God," he ſaid, "had without ſuch means preſerved and bleſſed, for many centuries, the ancient houſe of Oldenburg; and he would ſtill be preſent with him, through his mercy, and protect his ſubjects from deſtructive fires." He diſmiſſed, therefore, the ingenious author of this plan, but not without rewarding him according to his uſual liberality.

ADULTERATION OF WINE.

No adulteration of any article has ever been invented ſo pernicious to the health, and at the ſame time ſo much practiſed, as that of wine with preparations of lead; and as the inventor muſt have been acquainted with its deſtructive effects, he deſerves, for making it known, ſeverer execration than Berthold Schwartz, the ſuppoſed inventor of gunpowder.

The juice of the grape, when ſqueezed out, becomes wine through the firſt degree of fermentation; but ſcarcely has that begun when it approaches

proaches the ſecond degree, called the ſour fermentation. It then loſes its ſpirit; inſtead of which it becomes combined with an acid, which renders it unfit to be drunk, and of much leſs utility. The progreſs of the fermentation may be ſtopped by care and attention; but to bring the liquor back to its former ſtate is impoſſible; for the law of corruption is a law of nature, and admits of no exception. Ingenuity, however, has invented a fraudulent method of rendering the acid in ſpoilt wine imperceptible; ſo that thoſe who are not judges are often impoſed on, and purchaſe ſweetened vinegar inſtead of wine. Were no other articles uſed for ſweetening it than honey or ſugar, the adulterator would deſerve no ſeverer puniſhment than thoſe who ſell pinchbeck for gold; but ſaccharine juices can be uſed only when the liquor begins to turn ſour; and even then in very ſmall quantities, elſe it would betray the impoſition by its ſweetiſh-ſour taſte, and haſten that corruption it is intended to prevent. A ſweetener, therefore, has been invented much ſurer for the fraudulent dealer, but infinitely more deſtructive to the conſumer; and thoſe who employ it, undoubtedly, merit the ſame puniſhment as the moſt infamous poiſoners.

Lead and calx of lead, diſſolved in the acid which ſpoils wine, give it a ſaccharine taſte not unpleaſant, without any new, or at leaſt perceptible, tint, and ſtop the fermentation or corruption. The wine, however, occaſions, according as it is uſed in

a great

a great or ſmall quantity, and according to the conſtitution of the conſumer, a ſpeedy or lingering death, violent colics, obſtructions and other maladies; ſo that one may juſtly doubt whether, at preſent, Mars, Venus, or Saturn is moſt deſtructive to the human race.

The ancients, in my opinion, knew that lead rendered harſh wine milder, and preſerved it from acidity, without being aware that it was poiſonous. It was, therefore, long uſed with confidence; and when its effects were diſcovered they were not aſcribed to the metal, but to ſome other cauſe. When more accurate obſervation, in modern times, fully eſtabliſhed the noxious quality of lead, and when it began to be dreaded in wine, unprincipled dealers invented an artful method of employing it, which the law, by the ſevereſt puniſhment, has not been able wholly to prevent.

The Greeks and the Romans were accuſtomed to boil their wine over a ſlow fire, till only a half, third, or fourth part remained, and to mix it with bad wine in order to render it better. When, by this operation, it had loſt part of its watery particles, and had been mixed with honey and ſpices, it acquired ſeveral names, ſuch as *muſtum*, *mulſum*, *ſapa*, *carenum*, or *caroenum*, *defrutum**, &c. Even at

* Vino cognata res ſapa eſt, muſto decocto donec tertia ſuperſit. Ex albo hoc melius. *Plin.* lib. xxiii. cap. 2. Nunc defrutum, caroenum, ſapam conficies. Cum omnia uno genere conficiantur ex muſto, modus

at preſent the ſame method is purſued with ſack, Spaniſh, Hungarian, and Italian wines. In Italy new wine, which has been thus boiled, is put into flaſks, and uſed for ſallad and ſauces. In Naples it is called *muſto cotto*; but in Florence it ſtill retains the name of *ſapa*. Moſt of thoſe authors who have deſcribed this method of boiling wine expreſsly ſay that leaden or tin veſſels muſt be employed; becauſe the wine, by theſe, is rendered more delicious and durable, as well as clearer. It is, however, certain that muſt and ſour wine by ſlow boiling, for according to their directions it ſhould not be boiled quickly, muſt diſſolve part of theſe dangerous metals, otherwiſe the deſired effect could not be produced *. Some alſo were accuſtomed to add

dus his et virtutem mutabit, et nomina. Nam defrutum, a defervendo dictum, ubi ad ſpiſſitudinem fortiter deſpumaverit, effectum eſt. Caroenum, cum tertia perdita duæ partes remanſerunt. Sapa, ubi ad tertias redacta deſcenderit; quam tamen meliorem facient cydonia ſimul cocta, et igni ſuppoſita ligna ficulnea. *Palladius, Octob.* 18. edit. Geſneri, ii. p. 994.

* As a proof the following paſſages will be ſufficient: Ipſa autem vaſa, quibus ſapa aut defrutum coquitur, plumbea potius quam ænea eſſe debent; nam in coctura æruginem remittunt ænea, et medicaminis ſaporem vitiant. *Columella de re ruſtica*, lib. xii. c. 20.

Muſti quadrantalia viginti in aheneum aut plumbeum infundito, ignem ſubdito. *Cato de re ruſt.* cap. cv.

Cura quoque adhibenda eſt ut expreſſum muſtum perenne ſit, aut certe uſque ad venditionem durabile; quod quemamodum fieri debeat, et quibus condituris adjuvari, deinceps ſubjiciemus. Quidam partem quartam ejus muſti, quod in vaſa plumbea conjecerunt, nonnulli tertiam decoquunt; nec dubium, quin ad dimidium ſi quis excoxerit, meliorem

add to their wine, before it was boiled, a certain quantity of ſea water, which by its ſaline particles muſt neceſſarily accelerate the diſſolution *.

That the acid of wine has the power of diſſolving lead was not unknown to the ancients; for when the Greek and Roman wine-merchants wiſhed to try whether their wine was ſpoilt, they immerſed in it a plate of lead †. If the colour of the lead was changed, which undoubtedly would be the caſe when its ſurface was corroded and converted into calx, they concluded that their wine was ſpoilt. It cannot, however, be ſaid that they were altogether ignorant of the dangerous effects of ſolutions of that metal; for Galen and other phyſicians often give cautions reſpecting white lead. Notwithſtanding this, men fell upon the invention of

orem ſapam facturus ſit; eoque uſibus utiliorem, adeo quidem, ut etiam vice defruti, ſapa, muſtum, quod eſt ex veteribus vineis, condire poſſit. *Columella*, lib. xii. cap. 19.

Ipſa quoque defruta ac ſapas—coqui jubent—plumbeis vaſis, non æneis. *Plin.* lib. xiv. cap. 21.

Sapæ congios ſex quam optime infundito in aheneum, aut in plumbeum. *Cato*, cap. cvii.

* Proofs that the ancients mixed their wine with ſea-water may be found in *Pliny*, lib. xxiii. cap. 1. and lib. xiv. cap. 20. *Celſus* exclaims againſt it, lib. ii. cap. 25. *Dioſcorides*, lib. v. cap. 7. 9, &c. p. 573. See *Petri Andreæ Matthioli Commentarii in ſex libros Dioſcoridis de materia medica.* Venetiis, in officina Eraſmi Vincentii Valgriſii, 1553. fol.

† Vini in vitium inclinantis experimentum eſt laminæ plumbeæ mutatus in eo color. *Plin.* lib. xiv. cap. 20. This method of proof is given more circumſtantially in *Geopon.* lib. vii. cap. 15.

conveying

conveying water for culinary purpoſes in leaden pipes *; and even at preſent at Amſterdam, Paris, and other places water is conveyed through lead, and collected in leaden ciſterns, though that practice has, on ſeveral occaſions, been attended with alarming conſequences †. This negligence in modern times makes us not be ſurpriſed when we read that the ancients employed leaden veſſels. It appears, however, that it was not merely through negligence that this practice prevailed. They were acquainted, and particularly in Pliny's time, with various proceſſes uſed in regard to wine ‡; and among theſe was that of boiling it with lime or gypſum §; and the ancient phyſicians, who had

* Ultima ratio eſt, plumbeis fiſtulis aquam ducere, quæ aquas noxias reddunt. Nam ceruſa plumbo creatur attrito, quæ corporibus nocet humanis. *Pallad. Auguſt.* c. ii. vol. ii. p. 977.

† An account of experiments, made to aſcertain whether water can diſſolve lead, may be found in my tranſlation of *Sages Chemiſche unterſuchung verſchiedener mineralien*, p. 121. and in *Medical tranſactions publiſhed by the college of phyſicians in London*, vol. i. p. 291. Solution will hardly be poſſible as long as the water is perfectly pure; but it may eaſily acquire ſaline particles, and its power of diſſolving becomes then conſiderable. This circumſtance has not been remarked by Perrault, in his tranſlation of Vitruvius.

‡ Proprium inter liquores vino, muceſcere, aut in acetum verti; extantque medicinæ volumina. *Plin.* lib. xiv. cap. 20. The ſame author relates a great many arts practiſed in regard to wine.

§ Africa gypſo mitigat aſperitatem, nec non aliquibus ſui partibus calce. *Plin.* lib. xiv. cap. 19. That this method was practiſed in Italy is confirmed by *Columella*, lib. xii. cap. 20. and Didymus in *Geopon.* lib. vi. cap. 18. It is mentioned alſo by Dioſcorides and Theophraſtus.

not the aſſiſtance of our modern chemiſtry, thought it more probable that their wine was rendered noxious by the addition of theſe earths *, than by the veſſels in which it was boiled; and they were the more inclined to this opinion, as they had inſtances of the fatal effects produced by the uſe of them †. They decried them, therefore, ſo much, that laws were afterwards made by which they were forbidden to be uſed, as poiſonous and deſtructive to the human body.

Wine which has once begun to ſpoil cannot be perfectly reſtored by lime; for it cannot bring back to it the ſpiritous part which it has loſt, neither can it remove the acid with which it is incorporated; but it can render it imperceptible to the tongue by uniting with it, and forming an earthy ſalt of an almoſt inſipid taſte. This method of improving ſour wine is ſtill practiſed in the iſland of Zante ‡, in Spain §, on the coaſt of Africa ||, and

* Marmore enim et gypſo, aut calce condita quis non et validus expaverit! *Plin.* lib. xxiii. cap. 1.

† Exemplum illuſtre C. Proculeium Auguſti Cæſaris familiaritate ſubnixum in maximo ſtomachi dolore, gypſo poto, conſciviſſe ſibi mortem. *Plin.* lib. xxxvi. cap. 24.

‡ The wine of the iſland of Zante is almoſt as ſtrong as brandy. It is ſuppoſed that this proceeds from the unſlaked lime which is uſually mixed with it, under the pretence that it then keeps better, and is fitter to be tranſported by ſea. *Arvieux, Nachrichten von ſeiner reiſe*, vol. iii. p. 328.

§ Chriſtophori a Vega de arte medendi, lib. ii. cap. 2.

|| No one ſells wine at Tunis but the ſlaves, and this wine is not under

and in many other countries. It is, however, condemned by ſeveral phyſicians and chemiſts; becauſe obſtructions and other bad effects are to be apprehended from it *. Some, on the contrary, conſider it as harmleſs †; and I muſt confeſs that I ſhould expect no bad conſequences from ſuch a ſmall quantity of lime as would be neceſſary for that purpoſe. It will produce a ſalt which will have the ſame effects as that tartareous cruſt called wine-ſtone, and will act as a laxative, like the ſalts which our apothecaries prepare from that calcareous ſtone crab's-eyes, by means of vinegar or lemon-juice. The lime, which the acid of the wine cannot diſſolve, will fall to the bottom as a ſediment, and aſſiſt to clarify the wine. Uſed however in too great quantity, it may haſten the evaporation of the ſtill remaining ſpiritous part, and render the wine weak: a caution which has been given to wine-merchants by Neumann.

under the juriſdiction of the Tuniſian government. They put lime in it, which renders it very intoxicating. *Thevenots Reiſebeſchreibung*, vol. i. p. 399, according to the edition of Franckfort, 1693, 4to.

* Mr. Cartheuſer in his ſecond *Programma de quibuſdam vinorum adulterationibus, quæ additamentis mineralibus peraguntur.*

† See an eſſay on the corroſive quality of lime in wine in *Weber's Phyſikaliſch-chemiſchen magazin*, vol. ii. p. 112, where may be found ſome important experiments which ſeem to determine this point. In *Anleitung zur verbeſſerung der weine in Teutſchland*, Franek. and Leipſic 1775, 8vo, the moderate uſe of calx is recommended. In France potaſhes are put into wine inſtead of lime. See *Sages Chemiſche unterſuchung verſchiedener mineralien*, p. 128.

Gypſum is a calx combined with the vitriolic acid; and diſſolves in vinegar as well as water, like any other ſaline earth. Were it always fully ſaturated with its acid, its effects upon wine would be imperceptible: but as the moſt kinds of common gypſum contain abundance of looſe calcareous particles, they effervesce with acids; are diſſolved in part by them, and form that ſalt which I have before ſaid I conſider as harmleſs. By means of theſe particles gypſum improves ſour wine, as well as common lime *. I took half an ounce of that gypſum which at Oſterode is pounded and uſed as mortar, and which is hard, white and ſhining, and almoſt of the nature of alabaſter. When I had pounded it, I put it into ſtrong vinegar in a glaſs veſſel, and ſuffered it to boil for a few minutes. I then ſtrained it through filtering paper; and what remained, after it was waſhed and dried, weighed 215 grains; ſo that the vinegar had diſſolved 25 grains, which were precipitated afterwards by an alkali. I purſued the like proceſs with half an ounce of burnt gypſum, ſuch as is uſed here for floors; and I found that two ounces of the ſame vinegar diſſolved half a dram of it, which was ſomewhat more in proportion than of the former. Every one whom I cauſed to taſte of this vinegar remarked that both had loſt a conſiderable ſhare of their acidity; but that the vinegar which had been boiled with burnt

* See Beaumés Experimental-chemie, vol. i. p. 440.

gypſum had loſt the moſt. Few kinds of gypſum are completely ſaturated with the vitriolic acid; and at any rate we have no reaſon to ſuppoſe that the ancients ſought perfect gypſum for their wines. This method is not yet diſuſed. We are told by Arvieux *, that it is ſtill employed in the iſland of Milo; and I ſhall here take occaſion to obſerve that ſalt water alſo is added to wine there, even at preſent. Chriſtopher Vega, whom I have before quoted, reproaches the Spaniards with the uſe of gypſum; and it has been condemned by the modern as well as the ancient phyſicians, ſuch as Cartheuſer †. An Engliſhman of the name of Hardy ſeems to ſuſpect that gypſum contains lead and arſenical earth ‡; but it appears that this writer doubted whether our gypſum be the ſame as that of the ancients; and indeed it is neceſſary, before we uſe their information reſpecting natural objects, to examine carefully whether they underſtood by any name what we underſtand by it; and what they meant by gypſum has been determined neither by Stephanus, Ferber, nor Geſner. We however know this

* Vol. iv. p. 273.

† Ut ſupra, p. 7.

‡ The properties of lead and arſenic are well underſtood; but what thoſe of the ancient gypſums were, will require an explanation; as there ſeems to be juſt reaſon to believe, ſome of them contained a portion of metallic or arſenical earth. *A candid examination of what has been advanced on the colic of Poitou and Devonſhire*, by James Hardy, London, 1, 8vo, p. 84.

much, that the ancients burnt their gypſum, and that they formed and caſt images of it *. In my opinion wine cannot be poiſoned by gypſum; and wine-merchants who employ it and lime deſerve no ſeverer puniſhment than brewers, who, in the like manner, render ſour beer fitter to be drunk and more ſaleable.

That the ancients were accuſtomed to clarify their wine with gypſum is proved by different paſſages of the Greek writers on huſbandry. They threw gypſum into their new wine; ſtirred it often round, then let it ſtand for ſome time, and, when it had ſettled, poured off the clear liquor †. It would, however, appear that they had remarked that gypſum cauſed the ſpiritous part to evaporate; for we read that the wine acquired by it a certain ſharpneſs which it afterwards loſt, but that the good effects of the gypſum were laſting ‡. This proceſs in modern times has been publicly forbidden, in many countries, as in Spain § in the year 1348.

Calcined ſhells were in ancient times uſed inſtead of lime ||. Potters earth was alſo thrown into

* Hominis imaginem gypſo e facie ipſa primus omnium expreſſit, ceraque in eam formam gypſi infuſa emendare inſtituit Lyſiſtratus Sicyonius, frater Lyſippi. *Plin.* lib. xxxv.

† Geopon. p. 462. 483. 494.

‡ Geopon. vii. 12. p. 483.

§ Cæſarauguſtæ gypſum vino admiſceri ſolet, ne facile aceſcat; hoc vero antiqua lege anni 1348 prohibetur, quæ inſerta reperitur *Foris in uſu non habitis*, p. 12. *Introductio in oryctographiam et zoologiam Aragoniæ*, 1784, 8vo, p. 18.

|| Geopon. p. 486.

wine,

wine, in order to clarify it by carrying the muddy particles with it to the bottom *. This method I have ſeen employed in the breweries at Amſterdam, to purify the water. In the ſouth of France it is uſed for clarifying wine-ſtone ley; and in my opinion it might be uſeful on many other occaſions.

The ancients poiſoned their wine with lead without knowing it; but at what period did that pernicious practice begin of employing ſugar of lead and litharge? Litharge was not unknown to the ancients; for it is mentioned by Dioſcorides, Aetius and others. Sugar of lead is, indeed, more modern; but I have found no information reſpecting the invention of it, except that it was known to Paracelſus, who died in 1541, and who ventured to preſcribe it for ſome diſorders. It was known alſo to Angelus Sala, one of the moſt ingenious of the early chemiſts. In the Roman laws no particular orders occur againſt the adulteration or poiſoning of wine; for what we read in the *Inſtitutiones* † is applicable only to the ſpoiling of another perſon's wine, and thereby occaſioning a loſs to him; and this explanation is confirmed by the

* Geopon. p. 486.

† Denique reſponſum eſt, ſi quis in alienum vinum aut oleum id miſcuerit, quo naturalis bonitas vini aut olei corrumperetur, ex hac parte legis Aquiliæ eum teneri. *Inſtitut.* lib. iv. tit. 3. § 13.

Digeſta *. The German prohibitions againſt the adulteration of wine began in the fifteenth century, and were from time to time renewed with more ſeverity. In the preſent century, we have heard of complaints againſt this practice with lime, ſulphur and milk; but no inſtance occurs of the poiſoning with lead. I however conjecture that the uſe of litharge was introduced in the twelfth or thirteenth century; but the frames of the laws were not acquainted with the real poiſon; and inſtead of cauſing it to be examined by the chemiſts, who it muſt be confeſſed had not advanced far in their art, they contented themſelves with prohibiting the uſe of thoſe things which they found conſidered by the ancients as dangerous.

Among the oldeſt German prohibitions againſt the adulteration of wine is that of Nuremberg, in the year 1409; in which, however, there is no notice taken of litharge †. Another of the year 1475 is mentioned by Datt ‡; but ſome Imperial ones of an earlier period may have been loſt §. In the year

* Cum eo plane, qui vinum ſpurcavit, vel effudit, vel acetum fecit, vel alio modo vitiavit, agi poſſe Aquilias, Celſus ait; quia etiam effuſum et acetum factum, *corrupti* appellatione continetur. *Digeſtor.* lib. ix. tit. 2. leg. 27. § 15. Later Juriſts call the adulteration of wine *crimen ſtellionatus.* See *Harprecht, Reſp. crimin.* par. ii. p. 237, § 7.

† Gœcking's Journal von und für Teutſchland, 1784, i. p. 499.

‡ De pace imperii publica libri quinque, auctore I. P. Datt. Ulmæ 1698, fol. p. 632.

§ Goldaſt. Conſtit. imper. tom. ii. p. 114.

1487

1487 the emperor cauſed an order againſt the adulteration of wine to be publiſhed by the governments in Swabia, Franconia, and Alſace; and this practice was a ſubject of deliberation at the diet of Rothenburg, the ſame year, and alſo at the diet of Worms, under Maximilian I, in 1495. At the diet of Lindau the uſe of ſulphur was in particular prohibited, and alſo at Freyburg in Briſgau in 1498. In the year 1500 the ſame affair was diſcuſſed at Augſburg, and again at that city in 1548, under Charles V. It appears that this buſineſs was left afterwards to the care of the different princes, who from time to time iſſued prohibitions againſt ſo deſtructive a fraud.

Older and ſeverer prohibitions are, however, to be found in other countries. By an order of William count of Hennegau, Holland and Zeeland, of the year 1327, we find that long before that period it was cuſtomary to adulterate wine by noxious and dangerous ſubſtances. In the year 1384 the government at Bruſſels iſſued a ſeverer order of the like kind, in which vitriol, quickſilver, and lapis calaminaris are mentioned *. In France we find an old *ordonnance du prevôt de Paris*, for the ſame purpoſe, dated September the 20th, and December the 2d,

* W. F. Verhoevens Preisſchrift über den zuſtand der handwerke und handlung in den Niederlanden in dem 13ten und 14ten jahrhunderte, p. 96, and in Analyſe du mémoire de M. Verhoeven, p. 17. Both theſe pieces are inſerted in *Mémoires ſur les queſtions propoſées par l'académie de Bruxelles en* 1777. A Bruxelles 1778, 4to.

1371,

1371, in which no minerals are mentioned; but in that of 1696 litharge is particularly noticed *.

Conrade Celtes, who in the year 1491 was firſt crowned in Germany as a poet, gives in his panegyric on Nuremberg ſome information reſpecting the adulteration of wine, from which we learn that he conſidered it as a new invention, and aſcribed it to a monk called Martin Bayr; but his expreſſions are ſo figurative, that little can be gathered from them †. We are, however, told by Zeller, that

* Traité de la police, par De la Mare. Amſterdam 1729, fol. ii. p. 514.

† I wiſh thoſe who adulterate wine were puniſhed with greater ſeverity; for this execrable fraud, as well as many more deceptions, has been invented in the preſent age; and a villany by which the colour, taſte, ſmell and ſubſtance of wine are ſo changed as to reſemble that of another country, has been ſpread not only through Germany, but alſo through France, Hungary, and other kingdoms. It was invented, they ſay, by a monk named Martin Bayr, of Schwarzen-Eychen in Franconia. He undoubtedly merits eternal damnation for rendering noxious and deſtructive a liquor uſed for ſacred purpoſes, and moſt agreeable to the human body; thus contaminating and debaſing a gift of nature inferior to none called forth from the boſom of the earth by the influence of the ſolar rays; and for converting, like a cruel and ſanguinary deſtroyer of the human race, that beſtowed upon us by nature to promote mirth and joy, and as a ſoother of our cares, into a poiſon and the cauſe of various diſtempers. But if the debaſers of the current coin are puniſhed capitally, what puniſhment ought to be inflicted upon the perſon who hath either killed or thrown into diſeaſes all thoſe who uſed wine? The former by their fraud injure a few, but the latter expoſes to various dangers people of all ages, and of both ſexes; occaſions barrenneſs in women; brings on abortions and makes them miſcarry; corrupts and dries up the milk of nurſes; excites gouty pains in the body; cauſes others in the bowels and reins, than which none can be more excruciating; and produces ulcers in the inteſtines; in ſhort, his poiſon inflames,

that it was believed that this dangerous fraud was invented in France *. Martin Zeller, in his Chronicle of Swabia †, ſays, "In the year 1453, "the citizens of Augſburg began to obſerve this "fraud in the wine-market; for during four years "before, Martin Bayr, at Schwarzen-Eychen in "Franconia, firſt taught the German tavern keepers "and the waggoners, to preſerve new wine from "becoming ſour; to clarify wine by ſulphur; "and likewiſe to counterfeit it by ſpices, to the "great prejudice of people's health." In this paſſage, there is no mention of litharge, but of other mixtures. The oldeſt account of the poiſonous ſweetening of wine is that which occurs in the French ordinance ‡ of 1696; and

inflames, corrodes, burns, extenuates, and dries up; nor does it allay, but increaſe thirſt; for ſuch is the nature of ſulphur, which, mixed with other noxious and poiſonous things, the names of which I ſhould be aſhamed to mention, is added to wine, before it has done fermenting, in order to change its nature. This poiſon we have been obliged to purchaſe for our friends, wives, children and ſelves, at a high price; as wine has been ſcarce for ſeveral years paſt; and it would ſeem that nature had denied this liquor ſo long, out of revenge againſt her enemies and the deſtroyers of the whole human race. You ought, therefore, moſt prudent fathers, not only to empty their veſſels, by throwing this poiſon into your river; but to caſt alive into the flames the ſellers of this wine, and thus to puniſh poiſoning as well as robbery. *Pinkheimeri Opera*, Franck. 1610, fol. p. 136.

* Zelleri Diſſert. de docimaſia vini lithargyrio mangoniſati. Tubingæ 1707, § 1.

† Chronicum parvum Sueviæ; oder Kleines Schwabiſches zeitbuch. Ulm 1653, 4to. p. 65.

‡ De la Mare, Traité de la police, i. p. 615.

Zeller's

Zeller's conjecture that it was invented or firſt remarked in France, ſeems to me the more probable, as it appears that it was practiſed at Wurtemberg about the ſame period. In the year 1697 it was known there that ſome wine-merchants, particularly Hans George Staltſer at Goppingen, uſed litharge of ſilver for refining wine, and by theſe means deprived many perſons of life, and occaſioned the loſs of health to others. Staltſer pleaded in excuſe, that he conſidered the proceſs he had employed as harmleſs, and that Maſkoſky, phyſician to the town of Goppingen, who was accounted a man of knowledge, had employed the ſame for his wine. Brugel alſo, phyſician to the town of Heidenheim, had declared that litharge was not prejudicial; and as he was a perſon of reputation, his opinion had tended not a little to eſtabliſh the uſe of that practice. This report was ſo hurtful to the wine-trade of Wurtemberg, which at that time brought a great deal of money into the duchy from other countries, that the wine at Ulm remained unſold; and duke Everhard Louis was obliged to cauſe experiments to be made to aſcertain the nature of the ſubſtances mixed with it. Solomon Keyſel, the duke's phyſician, and J. Gaſpar Harlin, phyſician to the court, both declared that litharge was noxious, but that ſulphur beſprinkled with biſmuth was ſtill more ſo. They ſtrongly adviſed, therefore, that both theſe ſubſtances ſhould be forbidden to be uſed, under the heavieſt

heavieſt penalties; and this prohibition was put in force with the greater ſeverity, as ſome perſons of the firſt rank had for ſeveral years before cauſed their ſpoiled and ſour wine to be made ſweet and clear in this manner, by a weaver of Pforzheim, who reſided at Stutgart. An order was iſſued on the 10th of May 1697, forbidding this adulteration under pain of death and confiſcation of property, as well as of being declared infamous; and the duke requeſted the neighbouring ſtates, particularly Bavaria and Eychſtat, to keep a more watchful eye over their wine-merchants and waggoners, by which means it was ſuppoſed all danger would be avoided.

In the following year, the city of Ulm diſcovered a poor man at Giengen, within its own juriſdiction, who had ſweetened with litharge ſome ſour wine purchaſed at Wurtemberg. He was accordingly baniſhed from the country; and ſeveral other perſons in the duchy were condemned to labour at the fortifications. This example was attended with ſo good an effect, that for ſome time adulteration was not heard of; but eight years after, John Jacob Ehrni, of Eſſingen, introduced that practice again with ſome variation, and not only employed it himſelf, but induced others to follow it in ſeveral other places. Greater ſeverity was at length exerciſed. Ehrni was beheaded; the poſſeſſors of adulterated wine were fined, and the wine was thrown away. After this ſecond example, which

which was followed in other parts of the country, the art of adulterating wine ſeems to have been more carefully concealed, or to have been entirely abandoned *. But in the preſent century, treatiſes have been publiſhed on the management of wine, in which the art of improving it by litharge has been taught, as a method perfectly free from danger †.

For detecting metal in wine, the arſenical liver of ſulphur is commonly employed; a ſolution of which is called *liquor probatorius Wurtembergicus* ‡. This appellation, in my opinion, has been given to it becauſe it was firſt applied for that purpoſe by a public order in the duchy of Wurtemberg; though the invention is aſcribed to one of the duke's phyſicians ||. The uſe of it however is not attended with certainty: not only becauſe it precipitates all metals black without diſtinction, for lead is not the only one that we have reaſon to ſuſpect in wine; but becauſe this proof becomes very dubious when gypſum has been added to the wine alſo, for the blackneſs of the precipitate becomes then imperceptible by the whiteneſs of the earth §.

* Sattlers Geſchichte des herzogthums Würtemberg, xii. p. 82.

† William Graham's Art of making wines from fruit, flowers, and herbs. Sixth edit. London, 8vo.

‡ Sages Chemiſche unterſuchung verſchiedener mineralien, p. 132.

|| Anleitung zur verbeſſerung der weine in Teutſchland, p. 32.

§ See my Phyſicaliſch-ökonomiſche bibliothek, ix. p. 295. and Gmelins Einleitung in die chemie, p. 184.

The operation of fumigating wine with ſulphur is performed by kindling rags of linen dipped in melted brimſtone, and ſuffering the ſteam to enter a caſk filled, or partly filled, with that liquor. I do not know at what period this proceſs was invented; but it is worthy of remark, that we are told by Pliny *, that in his time ſome employed ſulphur in the preparation of wine. On this ſubject he quotes Cato; but the paſſage to which he alludes is not to be found in the works of that author handed down to us; and the method in which it was really uſed is conſequently unknown. Reaſon and experience ſhew that the vapour of ſulphur ſtops the fermentation ſo hurtful to wine, and prevents it from ſpoiling; and the beſt writers on the management of wine allow the free uſe of it for that purpoſe †. It can certainly do no injury to the health; and it was not neceſſary for the police, in different countries, to diſtribute preſcriptions for employing it, to forbid it, or to limit the quantity ‡, as it produces no other effect than that of

* Plin. Nat. Hiſt. lib. xiv. cap. 20.

† See the before-quoted *Anleitung* of Mr. Sprenger, and *Wieglebs Begriff von der gährung*. Weimar 1776. 8vo. p. 57. *Mémoire ſur la meilleure manière de faire et de gouverner les vins* - - - par l'abbé Rozier, 1772, 8vo.

‡ This was done at Rothenburg on the Tauber in 1497. It was ordered that half an ounce of pure ſulphur ſhould be employed for a caſk containing a tun of wine; and that when wine had been once expoſed to the vapour of ſulphur, it ſhould not undergo the ſame operation a ſecond time.

expelling

expelling the air which promotes corruption, and perhaps alſo the inflammable part, or, to ſpeak more according to the new mode, of confining the fixed air which it may contain.

Some wine-dealers are accuſtomed to ſprinkle over with biſmuth the rags dipped in ſulphur uſed for fumigating wine, and this addition is a German invention *. It has been ſeverely forbidden by expreſs laws; and there are undoubtedly ſufficient grounds for its being reprobated, becauſe that ſemimetal, which has an affinity to lead, is not only to be dreaded on its own account; but, as it is ſeldom pure, if uſed in too large a quantity, ſome of the metal diſſolved by the ſulphur may fall into the wine; and, as Pott obſerves, biſmuth and its calx are both ſoluble in vinous acid. At any rate, this metallic addition is of no uſe in any point of

* In John Hornung's *Ciſta medica*, Norimbergæ 1625, there are two letters from German phyſicians reſpecting this practice. Libavius ſays p. 165, Telam ſulphuratam quæ biſmuthum capit non laudo. Minerale hoc fumis peſtilentibus arſenicalibuſque eſt plenum - - - - Fors inventor ejus putavit facere ad defecandum vinum, ſicut videmus fieri muſto in ſtanneis vaſis ſervato; vel etiam ſtanno eodem liquato, et in dolia conjecto.

Doldius tells us, p. 447, Scis ſcopum eſſe præcipuum ſulphuratorum duplicem, tum ad vaſa tum ad vinum, potiſſimum tamen propter vinum excogitari a Germanis hæc miſtura ſolet; ſcilicet ut vina a putredine defendantur - - Veteres id tentabant coctione. - - Compendioſius Germani in frigidis regionibus id tentarunt per telas ſulphuratas, vel alia vim ſulphuris habentia—Accidere poteſt et illa cauſſa, quod biſmuthum inter ſtannum et plumbum magnam habet cognationem, quæ ſaporem valde dulcem et ſaccharinum de ſe præbent, forte inde aliqui etiam vino aliquam gratiam conciliare ſe poſſe crediderunt.

view,

view, as the moſt experienced dealers in wine have long ſince acknowledged.

In an old Imperial ordinance milk alſo is mentioned as an article uſed in the adulterating of wine. This method was known to and practiſed by the ancient Grecians *. But in the opinion of Von Rohr milk cannot be employed for that purpoſe †. "One can ſcarcely comprehend," ſays he, "how the framers of laws ſhould ever imagine that "a wine-dealer would be ſo ſimple as to adulterate "wine with milk; and thoſe who do ſo, deſerve "not to be puniſhed for their folly. As they will "find no purchaſers to wine adulterated by ſo "ſtrange a mixture, that puniſhment will be ſuf-"ficient." The effects of milk however may be eaſily comprehended. It cauſes the wine to throw up a ſcum, which carries with it every impurity; and this being taken off along with it, the wine muſt of courſe be rendered much clearer. However, though this mixture cannot be called an adulteration, it is certain that wine may be refined much better by iſinglaſs, and that method is followed at preſent ‡.

I ſhall obſerve in the laſt place, that in the year 1472 Stum-wine, as it is called, was prohibited

* Geopon. p. 486. 502.—Lemnius de miraculis occultis naturæ. Coloniæ 1581, 8vo. p. 291: Vinum corruptum ac glutinoſum lacte bubulo modice ſalito reſtauratur.

† See Hauſhaltungs-recht. Leipſic 1716, 4to. p. 1393.

‡ Anleitung zur verbeſſer. der weine, p. 163.

as a bad liquor prejudicial to the health*. By this term is underſtood wine, the fermentation of which has been checked, and which on that account continues ſweet; ſeldom becomes clear; and, even when it clarifies, turns muddy when expoſed to the air, becauſe the fermentation, which has been ſtopped, again commences †. Wines of this kind are allowed at preſent. They are called *vina muta* or *ſuffocata*, and have a great reſemblance to a ſort of wine made principally at Bourdeaux, to which the French give the name of *vin en rage*.

* Von Lerſner, Chronica der ſtadt Frankfurt, ii. p. 683. Wine ſeaſoned with muſtard, and which was ſold as boiled wine, was forbidden at the ſame time. See p. 684. In the year 1484 wine mixed with the herb mugwort was prohibited alſo.

† Anleitung, *ut ſupra*, p. 93, 128.

CLOCKS

CLOCKS AND WATCHES.

A PAPER on this ſubject was read by profeſſor Hamberger, in the year 1758, before the Society of Gottingen; but as the publication of the Tranſactions of the Society was interrupted, it was never printed. I, however, procured the manuſcript from the poſſeſſor's ſon, Secretary Hamberger, at Gotha, and I here inſert it, corrected in a few places, where neceſſary, but without any alteration *.

"Weidler † and Chambers ‡ are, doubtleſs, both miſtaken when they place the invention of automatous clocks about the end of the fifteenth or beginning of the ſixteenth century. The latter ſays, It is certain that the art of conſtructing clocks, ſuch as thoſe now in uſe, was firſt invented or at leaſt revived in Germany about two hundred years ago. The ſame account is given by Weidler, whom Chambers perhaps copied. But,

* The Tranſlator has omitted the introduction, which was only a ſummary of what is contained in the paper itſelf, and alſo about two pages in the beginning of the paper. The Author ſays, that the principal writers on this ſubject are Alexander, a monk of the order of St. Benedict; Paute, his countryman; and our Derham.

† Hiſtor. Aſtron.

‡ Encyclopædia, art. Clock.

however flattering this opinion may be to the ingenuity of the Germans, it is ſo apparently falſe in regard to the time, that one cannot aſſent to it; nor is it even probable in regard to the country, though it muſt be allowed that the art of clock-making flouriſhed very much in Germany, particularly at Nuremberg, about the beginning of the ſixteenth century.

" As theſe two authors make the invention of clocks too modern, others, on the contrary, carry it back to a period too early. Without entering into any diſſertation on the machines of Archimedes and Poſidonius, which are ſaid to have meaſured the hours of the day, I ſhall only obſerve that a certain writer pretends to have found mention made of a clock in the third century *. In ſupport of this aſſertion he refers to the Acts of St. Sebaſtian, the martyr †, where Chromatius, the governor of Rome, ſays, when about to be cured by him, 'Habeo cubiculum holovitreum, in quo omnis diſciplina ſtellarum ac matheſis mechanica eſt arte conſtructa, in cujus fabrica pater meus Tarquinius amplius quam ducenta pondo auri dignoſcitur expendiſſe.' St. Sebaſtian anſwers, 'Si hoc tu integrum habere volueris, te ipſum frangis.' To which Chromatius replies: 'Quid enim? Matheſis

* Bona De div. pſalmod. cap. 3. ſ. 2.

† Act. SS. Antv. cap. 16. 20 Jan. p. 273.

aut

aut ephemeris aliquo ſacrificiorum uſu coluntur, cum tantum eis menſium et annorum curſus certo numero per horarum ſpatia diſtinguuntur? Et lunaris globi plenitudo, vel diminutio, digitorum motu, rationis magiſterio, et calculi computatione praevidetur?'—This valuable machine, however, can hardly be called a clock; for if it had been an automaton, it would not have required to be moved with the fingers in order to ſhew the time of full moon. If I underſtand the author's words properly, it was not calculated to point out the hours; but to exhibit the ſun's courſe through the twelve ſigns of the zodiac, the motion of the reſt of the planets, and their relative ſituation in every month, or at any period of the year. That the ſigns of the zodiac and the planets were repreſented on the machine, appears from what follows. St. Polycarp (the companion of St. Stephen) ſaid: 'Illic ſigna Leonis, et Capricorni, et Sagittarii, et Scorpionis, et Tauri ſunt; illic in Ariete Luna, in Cancro hora, in Jove ſtella, in Mercurio tropica, in Venere Mars, et in omnibus iſtis monſtruoſis daemonibus ars Deo inimica cognoſcitur.'—But whatever this machine might have been, it was of no uſe to others, or to poſterity: it was broken to pieces by theſe ſaints, ſo that, even allowing it to have been a clock, the knowledge of it muſt have been then loſt.

"We find, alſo, that Bernardus Saccus * aſcribes the invention of clocks to Boethius, in the fifth century; but Bernardus ſeems to have forgotten what he quoted a little before from Caſſiodorus †, reſpecting the clock of Boethius, that it determined the hours *guttis aquarum*. It muſt, therefore, have been a water-clock, and not a clock moved by wheels and weights. The ſame Caſſiodorus ‡ had provided his monks at the monaſtery of St. Andiol ||, in Languedoc, with machines of the like kind: 'Horologium vobis unum,' ſays he, 'quod ſolis claritas indicet, praeparaſſe cognoſcor; alterum vero aquatile, quod die noctuque horarum iugiter indicat quantitatem; quia frequenter nonnullis diebus ſolis claritas abeſſe cognoſcitur.' We are to underſtand, alſo, as alluding to ſuch clocks, what is ſaid by the writer of the life of St. Leobin, biſhop of Chartrain, about the year 556 §, when he tells us: ei (Leobino) temperandi curſus horarum et vigiliarum diligentiam commiſſam eſſe.

"I come now to the ſeventh century. In Du Freſne's *Lexicon mediæ et infimæ Latinitatis* we find

* Hiſt. Ticin. lib. vii. c. 17.

† Var. lib. i. in fine.

‡ De Inſtitut. div. litter. c. 29.

|| In the original, *Monaſterium Vivarienſe*. TRANS.

§ Mabil. Annales St. O. B. ſec. i. p. 123.

the

the word *Index*, which is explained to be the index or hand of a clock, or the ſmall bell which announces the hours by its ſound; and this opinion is adopted by Muratori *. Du Freſne quotes in ſupport of his aſſertion a monkiſh work called *Regula Magiſtri*, the author of which is not certainly known †, but which Mabillon ‡ aſſerts to have been written before the year 700. The paſſages to which he refers are: Cum adveniſſe divinam horam percuſſus in oratorio index *monſtraverit*.—Cum *ſonuerit index*—and Cum ad opus divinum oratorii *index ſonaverit* ||. But Du Freſne might have perceived that a clock is not here alluded to, had he quoted the whole paſſage from the fifty-fifth chapter; for it is there ſaid, not merely *cum ſonuerit index*, but *cum ſonuerit index ab Abbate percuſſus*. It was a *ſcilla*, or *ſkella*, perhaps only a board; and Martene § ſeems to underſtand the word *index* in the propereſt ſenſe when he explains it *ſignum quo fratres vocabantur ad divina officia*.

" That machine which was ſent as a preſent to Charlemagne by the king of Perſia, in the year 807, is ſuppoſed alſo to have been a clock like thoſe uſed at preſent; and if we follow the *Chro-*

* Muratori, Antiq. med. ævi. diſſ. 24. p. 392.

† Lucæ Holſtenii Codex regularum. Pariſ. 1663, p. 172.

‡ Annales.

|| Cap. 54. cap. 55. and cap. 95.

§ Index onomaſticus ad tom. iv. De antiq. eccl. rit.

nicon Turonenſe *, one may eaſily fall into the ſame opinion: ‘ Miſit rex Perſarum—horologium, in quo XII horarum curſus cognoſcebantur, cymbalo ibi perſonante et equitibus, qui per ſingulas horas per feneſtras exibant, et in ultima hora diei redeuntes, in regreſſione ſua feneſtras apertas claudebant.’ The deſcription of it however to be found in *Annales Francorum* †, aſcribed to Eginhard, ſhews clearly that it was far different from our clocks. The author ſays: ‘ Nec non et horologium, ex aurichalco arte mechanica mirifice compoſitum, in quo duodecim horarum curſus ad clepſydram vertebatur, cum totidem æreis pilulis, quæ ad completionem horarum decidebant, et caſu ſuo ſubjectum ſibi cymbalum tinnire faciebant.’—It was evidently therefore a water-clock, furniſhed with ſome ingenious mechaniſm, but having nothing in common with our clocks.

“ About the ſame period lived Pacificus, archdeacon of Verona, who is celebrated for having invented a clock ‡. His epitaph, beſides relating other ſervices which he did, ſays:

Horologium nocturnum nullus ante viderat.
En invenit argumentum et primus fundaverat;
Horologioque carmen ſpheræ cœli optimum,
Plura alia graviaque prudens invenit.

* Martene, Coll. ampl. tom. v. p. 960.

† Ad a. 807. Calmet. Hiſt. de Lorraine, vol. i. p. 582.

‡ Onuphr. Panuvini Antiq. Veron. lib. vi. p. 153. *Scip. Maffei Degli ſcrittori Veroneſi*, p. 32. *Muratori, Ant. Ital. med. ævi*, diſſ. 24. p. 392.

Scipio

Scipio Maffei endeavours to prove, that we are here to underſtand a clock moved by wheels and weights; but, in my opinion, his arguments are extremely weak. 'This *horologium*,' ſays he, 'the like of which had been never ſeen, and which was different from a ſun-dial, becauſe it ſhewed the hours in the night-time, could not be a clepſydra or water-clock, for clocks of that kind were not only known to the ancients, but even to the inhabitants of Italy in latter times, ſo that it could have been nothing but a clock like ours.' But, even if we allow, with this learned man, that water-clocks were known in Italy at that period, it cannot be denied that they were ſcarce, and uſed only by few, as may be evidently gathered from what is ſaid of theſe machines by Caſſiodorus. The greater part of people might have been unacquainted with them at the above-mentioned time; and there is no neceſſity for adhering ſo cloſely to the words of the epitaph, *nullus ante viderat*, as Maffei has done. Beſides, Maffei himſelf deſtroys the foundation on which he reſts his opinion; for he relates that a *horologium nocturnum* was ſent to Pepin, king of France, by pope Stephen II. This appears from the pope's own letter; but Maffei is under a miſtake reſpecting the name, for it was Paul, and not Stephen. The letter, which may be found in the *Codex Carolinus* *, is dated in the

* Bouquet, Script. rer. Gall. et Franc. tom. v. p 513.

year 756. Maffei thinks that this machine was of a conſtruction different from that of a water-clock; but if it pointed out the hours in the day-time, as well as in the night, according to his ſuppoſition, there is no reaſon, as Muratori obſerves, why it ſhould have been called *horologium nocturnum*. In my opinion, we ought here to underſtand a clepſydra, or water-clock, ſuch as that uſed by Caſſiodorus for the like purpoſe, and which Hildemar recommended in the ninth century to the monks, who were obliged to obſerve the hours. Hildemar ſays, He who wiſhes to do this properly, muſt have *horologium aquæ* *.

"That theſe water-clocks however were then ſcarce, as well as in the following centuries, we have reaſon to conclude from their being ſo little ſpoken of in the writings of thoſe periods. In the ancient cuſtoms of the monaſtery of St. Viton, at Werden †, written as is ſaid in the tenth century, no mention of them occurs; and the monks regulated their prayers by the crowing of the cock; for it is ſaid: *Cum lucem ales nunciaverit, dabuntur omnia ſigna in reſurrectione Domini noſtri*, &c. I find as little mention of them in the eleventh century, even in paſſages where they could not have been omitted, had they been known. Thus, in a little work,

* Commentar. in Reg. S. Bened. cap. 8. See *Martene De ritib. eccl.* tom. iv. p. 5.

† Martene, tom. iv. p. 853.

by

by Pet. Damiani, *De perfectione Monachorum* *, where the author ſpeaks of the *ſignificator horarum*, he does not ſo much as allude to a clepſydra. That the reader may know what he means by *ſignificator horarum*, I ſhall here quote his own words: 'Non fabulis vacet, non longa cum aliquo miſceat, non denique, quid a ſecularibus agatur, inquirat; ſed commiſſæ ſibi curæ ſemper intentus, ſemper providus, ſemperque ſollicitus, volubilis ſphæræ neceſſitatem, quieſcere neſcientem, ſiderum tranſitum, et elabentis temporis meditetur ſemper excurſum. Porro pſallendi ſibi faceat conſuetudinem, ſi diſcernendi horas quotidianam habere deſiderat notionem; ut, quandocunque ſolis claritas, ſive ſtellarum varietas nubium denſitate non cernitur, illic in quantitate pſalmodiæ, quam tenuerit, quoddam ſibi velut horologium metiatur.'

Some aſcribe the invention of our modern clocks to Gerbert, who, in the tenth century, was raiſed to the pontifical chair at Rome, under the name of Sylveſter II, and who was reckoned to be the firſt mathematician and aſtronomer of his time †. This opinion however is ſupported only by mere conjecture, and appears to be falſe from the account of Dithmar ‡, who ſays: 'Gerbertus, a finibus ſuis

* Cap. 17.

† Journal des Sçavans 1734, p. 773. *Goujet, Etat des ſciences depuis la mort de Charlemagne, juſqu' à celle du Roi Robert.* Paris 1737, 8vo.

‡ Chron. lib. vi. p. 83. edit. Francof. 1580. fol.

expulſus,

expulſus, Ottonen petiit imperatorem, et cum eo diu converſatus, in Magdaburg horologium fecit, illud recte conſtituens, conſiderata per fiſtulam quadam ſtella nautarum duce.' No mention is made here of wheels or weights, and this horologium ſeems to have been a ſun-dial, which Gerbet fixed up by obſerving the pole-ſtar. It appears, indeed, that Gerbert was acquainted with no other kind of *horologia*; for thoſe who ſpeak of his book *De Aſtrolabio*, in which he explains the method of conſtructing dials for various latitudes, produce no farther proofs *. Some, according to the teſtimony of Kircher, conſider this *horologium* to have been a portable dial, which ſhewed the hour when properly ſet by the help of a needle touched with a magnet; but even this opinion is not warranted by the words of Dithmar.

" The anonymous author of the Life of William, abbot of Hirſhau †, who lived in the eleventh century, and who was a very learned man for his time, ſays: *naturale horologium ad exemplum cæleſtis hæmiſpherii excogitaſſe.* Though this paſſage is ſo ſhort, that no idea can be formed from it of the conſtruction of the machine, it is evident that it alludes neither to a ſun-dial nor to a water-clock, but to ſome piece of mechaniſm which pointed out the

* Le Beuf, Rec. de div. écrits, &c. vol. ii. p. 89.

† Publiſhed by Car. Stengelius. Aug. Vind. 1611. p. 1.

hours

hours and exhibited the motion of the earth and other planets. As more frequent mention of *horologia* occurs afterwards, and as, in ſpeaking of them, expreſſions are uſed which cannot be applied to ſun-dials or water-clocks, I am induced to think that the invention of our clocks belongs to this period. In the *Conſtitutiones Hirſaugienſes*, or *Gengebacenſes*, of the ſame William *, it is ſaid of the ſacriſtan, *eum horologium dirigere et ordinare*. In the like manner Bernardus Monachus, a writer of the ſame century, ſays, in the *Ordo Cluniaſcenſis* †, 'apocriſiarium horologium dirigere et diligentius temperare.' The ſame author, in the Ancient Cuſtoms, &c. of the Monaſtery of St. Victor, at Paris ‡, written alſo about the ſame time, ſays, that the regiſter *(matricularius)*, the ſacriſt's companion, ought 'horas canonicas nocte et die ad divinum celebrandum cuſtodire, ſigna pulſare, *horologium temperare*.'

"The unequal hours then in uſe rendered this regulating of the *horologia* neceſſary. The days and the nights conſiſted of twelve hours each; but ſometimes ſhorter and ſometimes longer. The reaſon of this is explained in the ſixty fourth chapter of the before-mentioned *Cuſtoms*, where it is

* Lib. ii. cap. 34. Vet. diſciplina monaſt. p. 520.

† Part i. cap. 51. Ibid. p. 246.

‡ Cap. 23. ap. Martene De ant. rit. tom. iii. p. 739.

ſaid:

ſaid: 'Ab æſtivali ſolſtitio uſque ad ſolſtitium hiemale ſic horologium temperetur, quatenus illud noctis ſpatium, quod matutinas præcedat, per ſingulos menſes ſecundum incrementa noctium aliquantulum creſcat, donec paulatim creſcendo tandem in hiemali ſolſtitio ſpatium illud, quod eſt ante matutinas, ad illud quod ſequitur, duplum fiat. Similiter per contrarium ab hiemali ſolſtitio uſque ad æſtivale ſolſtitium ſic temperetur, quatenus ſpatium, quod præcedit, ſecundum noctium decrementum per ſingulos menſes decreſcat, donec paulatim deſcreſcendo, tandem in ſolſtitio æſtivali ſpatium, quod eſt ante matutinas, et quod poſt ſequitur, æquale fiat.' Such was the regulating of the *horologia*, and I much doubt whether it could be applied to water-clocks.

"Theſe *horologia* not only pointed out the hours by an index, but emitted alſo a ſound. This we learn from *Primaria Inſtituta Canonicorum Præmonſtratenſium* *, where it is ordered that the ſacriſtan ſhould regulate the *horologium* and make it ſound before matins to awaken him. I dare not however venture thence to infer, that theſe machines announced the number of the hour by their ſound, as they ſeem only to have given an alarm at the time of getting up from bed. I have indeed never yet found a paſſage where it is mentioned that the

* Diſſ. ii. c. 8. ap. Martene De ant. rit. tom. iii. p. 909.

number of the hour was expreſſed by them; and when we read of their emitting a ſound, we are to underſtand that it was for the purpoſe of waking the ſacriſtan to morning-prayers. The expreſſion *horologium cecidit*, which occurs frequently in the before-quoted writers, I conſider as alluſive to this ſounding of the machine *. Du Freſne, in my opinion, under the word *horologium*, conceives wrong the expreſſion *de ponderibus in imum delapſis*, becauſe the machine was then at reſt, and could rouſe neither the ſacriſtan nor any one elſe whoſe buſineſs it was to beat the *ſcilla*.

"I ſhall now produce other teſtimony which will ſerve farther to confirm what I have here ſaid of the origin of clocks. Calmet, in his Commentary on the *Regulæ S. Benedicti* †, quotes from a book on the uſages of the Ciſtercians, three paſſages which I ſhall give as he has tranſlated them, becauſe I have not acceſs at preſent to the original. 'On lit,' ſays he, 'au chap. 21 de la première partie de leurs Uſages, compilez vers l'an 1120, qu'on ne fera ſonner les cloches pour aucun exercice, pas même pour l'Horloge, dépuis la meſſe du Jeudi ſaint juſqu'à celle du Samedi ſaint; et au chap. 114, il eſt ordonné au ſacriſtain de regler l'Horloge, en

* Wilhelm. Hirſaug. Conſuet. lib. ii. c. 29. *Bernardus Monach. Ordo Clun.* pars i. c. 52. *Udalrici Mon. Conſuetud. Clun.* lib. iii. c. 12. ap. *D'Archery*, tom. iv. ed. vet. tom. i. p. 603. ed. nov.

† Tom. i. p. 280.

ſorte

ſorte qu'elle ſonne, et qu'elle l'éveille pendant l'hyver avant matines, ou avant les nocturnes; et au chap. 68 et 114, que quand on s'eſt levé trop tôt, le ſacriſtain avertît celui qui lit la dernière leçon, de la prolonger juſqu'à ce que l'Horloge ſonne, ou qu'on faſſe ſigne au lecteur de ceſſer.'

"The uſe of theſe machines muſt have been continued from that period, for we find them mentioned in the thirteenth century, in the commentary of Bernardus Caſſinenſis (Bernard of Caſſino) on the unpubliſhed *Regulæ S. Benedicti*, from the eighth chapter of which Martene * gives the following quotation: 'Facta autem jam hora octava, modicum erit amplius de media nocte quando ſurrexerit, *horologio excitante*, qui habet horologium cuſtodire, et accenſis lucernis eccleſiæ, quæ poterant propter prolixitatem noctis fuiſſe obſcuratæ, ac pulſatis campanis ad dormientium fratrum excitationem, potuit tranſire dimidia octavæ horæ antequam ſurrexerint fratres.' It is ſaid alſo in the *Chronicon Mellicenſe* †, in Du Freſne: 'Excitabit aliquis a ſuperiore deputatus, qui *horologium excitatorium* habeat; ad omnes quoque cellas lumen deferat.'

"As all arts are at firſt imperfect, it is obſerved of theſe clocks that they ſometimes deceived; and

* Rit. ant. tom. iv. p. 5.

† Cap. 774.

hence,

hence, in the *Ordo Cluniacenſis Bernardi Mon.* * the perſon who regulated the clock is ordered, in caſe it ſhould go wrong, 'ut notet in cereo, et in curſu ſtellarum vel etiam lunæ, ut fratres ſurgere faciat ad horam competentem.' The ſame admonition is given in the *Conſtitutiones Hirſaugienſes* †.

"From what has been ſaid I think it is ſufficiently apparent that clocks moved by wheels and weights began certainly to be uſed in the monaſteries in Europe, about the eleventh century. I do not, however, think that Europe is entitled to the honour of this invention; but that it is rather to be aſcribed to the Saracens, to whom we are indebted for moſt of the mathematical ſciences. This conjecture is ſupported by the *horologium* which, as Trithemius ‡ tells us, was ſent by the ſultan of Egypt, in the year 1232, to the emperor Frederic II. 'Eodem anno,' ſays he, 'Saladinus Egyptiorum Frederico imperatori dono miſit per ſuos oratores tentorium pretioſum, mirabili arte compoſitum, cujus pretii æſtimatio quinque ducatorum millium procul valorem exceſſit. Nam ad ſimilitudinem ſphærarum cæleſtium intrinſecus videbatur conſtructum, in quo imagines ſolis, lunæ ac reliquorum planetarum artificioſiſſime compoſitæ

* P. 1. c. 51.

† Lib. ii. c. 34.

‡ Chron. Hirſaug. ad. h. a.

movebantur ponderibus et rotis incitatæ ; ita videlicet, quod, curſum ſuum certis ac debitis ſpatiis peragentes, horas tam noctis quam diei infallibili demonſtratione deſignabant ; imagines quoque xii ſignorum zodiaci certis diſtinctionibus ſuis motæ cum firmamento curſum in ſe planetarum continebant.'

" The writers of this century ſpeak in ſuch a manner of clocks that it appears they muſt, at that period, have been well known. Gulielmus Alvernus *, diſputing againſt thoſe who deny the exiſtence of the ſoul, after producing various arguments, thus obviates one which might be uſed againſt him. Nec te conturbant, inquit, motus horologiorum, qui per aquam fiunt, et pondera, quæ quidem ad breve tempus et modicum fiunt, et indigent renovatione frequenti, et aptatione inſtrumentorum ſuorum, atque operatione forinſecus, aſtrologi videlicet qui peritiam habet hujus artificii. In corporibus vero animalium vel etiam vegetabilium totum intus eſt, intra ea ſcilicet, quod motus eorum atque partium ſuarum moderatur, et regit, ac modis omnibus perficit.' And Dante, the Italian poet, ſays † :

E come cerchi in tempra d'orivoli
Si giran, ſi che'l primo, a chi pon mente
Quieto pare, e l'ultimo che voli, &c.

* De anima, c. i. p. 7, 72.

† Parad. cant. xxiv. ver. 13.

" In

" In the fourteenth century mention is made of the machine of Richard Walingford, which has been hitherto conſidered as the oldeſt clock known. The deſcription of it I ſhall give in the words of Leland * : ' Electus in monaſterii præſidem—cum jam per amplas licebat fortunas, voluit illuſtri aliquo opere non modo ingenii, verum etiam eruditionis ac artis excellentis miraculum oſtendere. Ergo talem horologii fabricam magno labore, majore ſumtu, arte vero maxima compegit, qualem non habet tota, mea opinione, Europa ſecundam ; ſive quis curſum ſolis ac lunæ, ſeu fixa ſidera notet, ſive iterum maris incrementa et decrementa, ſeu lineas una cum figuris ac demonſtrationibus ad infinitum pene variis conſideret : cumque opus æternitate digniſſimum ad umbilicum perduxiſſet, canones, ut erat in matheſi omnium ſui temporis facile primus, edito in hoc libro ſcripſit, ne tam inſignis machina errore monachorum vileſceret, aut incognito ſtructuræ ordine ſileret.' This machine, if I remember right, was called by the inventor Albion (all by one).

" Clocks hitherto had been, as it were, ſhut up in monaſteries ; but they now began to be employed for the common uſe and convenience of cities, though no inſtance of this is to be found before the above period. Hubert prince of Car-

* In Tanneri Biblioth. Brit. Hibern. p. 629.

rara cauſed the firſt clock ever publicly erected, to be put up at Padua, as we are told by Petrus Paulus Vergerius *: 'Horologium quo per diem et noctem quatuor et viginti horarum ſpatia ſponte ſua deſignarentur, in ſumma turri conſtituendum curavit.' It is ſaid to have been made by James Dondi, whoſe family afterwards got the name of *Horologio* †. In remembrance of this circumſtance the following verſes were inſcribed on his tomb-ſtone:

Quin procul excelſæ monitus de vertice turris
Tempus, et inſtabiles numero quod colligis horas,
Inventum cognoſce meum, gratiſſime lector.

"John Dondi, ſon of the former, acquired no leſs fame by a clock which he conſtructed alſo, and which is thus deſcribed: 'In quo erat firmamentum ‡, et omnium planetarum ſphæræ, ut ſic ſiderum omnium motus, veluti in cœlo, comprehendantur; feſta edicta in dies monſtrat, plurimaque alia oculis ſtupenda; tantaque fuit ejus horologii admiranda congeries, ut uſque modo poſt ejus relictam lucem corrigere, et pondera convenientia aſſignare ſciverit aſtrologus nemo. Verum de Francia nuper || aſtrologus et fabricator mag-

* In Vit. princip. Carrar. ap. Murator. tom. xvi. p. 171.

† See Scardeonius de antiq. urbis Patavii, lib. ii. claſſ. 9. p. 205. ed. Baſil. 1560, fol. and the authors which he quotes.

‡ Theſe are the words of Mich. Savanarola in *Comm. de laud. Patav.* in *Muratori*, vol. xxiv. col. 1164.

|| Sec. xiv.

nus,

nus, fama horologii tanti ductus, Papiam venit, plurimiſque diebus in rotas congregandas elaboravit; tandemque actum eſt, ut in unum, eo quo decebat ordine, compoſuerit, motumque ut decet dederit.'

"We are informed by the *Chronica miſcella Bononienſis* *, that the firſt clock at Bologna was fixed up in the year 1356: 'A di 8 di Aprile fu tolta via la campana groſſa della torre, ch'era nel palazzo di Meſſer Giovanni ſignor di Bologna, il qual palazzo dicevaſi della Biada; e fu menata nella Corte del Capitano, e tirata e poſta ſulla Torre del Capitano nel Mercoledi Santo; e queſto fu l' orologio, il quale fu il primo, che aveſſe mai il Comune di Bologna, e ſi commincio a ſonare a di 19 di Maggio, il quale lo fece fare Meſſer Giovanni.

"Some time after the year 1364, Charles V, ſurnamed the Wiſe, king of France, cauſed a large clock to be placed in the tower of his palace, by Henry de Wyck †, whom he invited from Germany, becauſe there was then at Paris no artiſt of that kind, and to whom he allowed a ſalary of ſix ſols per day, with free lodging in the tower.

"Towards the end of the century, about the year 1370, Straſburgh alſo had a clock, a deſcrip-

* In Muratori, tom. xviii. p. 444.

† Moreri, Diction. art. Horloge du Palais.

tion of which is given by Conradus Daſypodius *.

Courtray, about the ſame period, was celebrated for its clock, which was carried away by the duke of Burgundy, in the year 1382. This circumſtance is thus related by Froiſſard, a cotemporary writer †: 'Le duc de Bourgogne fit oſter un horloge (qui ſonnoit les heures), l'un des plus beaux qu'on ſeuſt trouver deçà ne delà la mer: et celui horloge fit tout mettre, par membres et pieces, ſur chars, et la cloche auſſi. Lequel horloge fut amené et charroyé en la ville de Digeon en Bourgogne: et fut là remis et aſſis: et y ſonne les heures vingt-quatre, entre jour et nui.'

"We are told by Lehmann ‡, that a public clock was put up at Spire in the year 1395. 'That year, ſays he, the clock was erected on the Altburg gate. The bell for calling the people together to divine worſhip was caſt by a bell-founder from Straſburgh.—The works of the clock coſt fifty-one florins.'

"The greater part however of the principal cities of Europe were at this period without ſtriking-

* In the Account of the aſtronomical clock at Straſburgh, to be found in *Iac. von Königſhovens Elſaſs und Straſb. Chronik*, p. 574.

† Vol. ii. c. 128. p. 229.

‡ Lib. vii. c. 69, towards the end.

clocks,

clocks, which could not be procured but at a great expence. Of this we have an inſtance in the city of Auxerre. In the year 1483, the magiſtrates reſolved to cauſe a clock to be conſtructed; but as it would coſt a larger ſum of money than they thought they had a right to diſpoſe of by their own authority, they applied to Charles VIII, to requeſt leave to employ a certain part of the public funds for that purpoſe *.

" The great clock in the church of the Virgin Mary at Nuremberg was erected, as we read, in the year 1462 †.

" A public clock was put up at Venice in the year 1497 ‡.

" In the ſame century an excellent clock, which is deſcribed in a letter of Politian || to Francis Caſa, in the year 1484, was conſtructed by one Lorenzo, a Florentine, for Coſmo I of Medici.

" Towards the end of this century, clocks began to be in uſe among private perſons. This appears from a letter of Ambroſius Camaldulenſis § to Ni-

* Le Beuf, Mem. concernant l'hiſt. d'Auxerre, vol. ii. p. 342.

† Doppelmayer, p. 282.

‡ Theſ. Ital. tom. iii. p. 3. p. 308.

|| Politiani Opera. Lugduni 1533, 8vo. p. 121.

§ Lib. xv. epiſt. 4.

colaus, a learned man of Florence: 'Horologium tuum mox, ut tuas accepi literas, paravi, miſiſſemque, ſi fuiſſet præſto qui afferret. Ipſam mundari feci, nam erat pulvere obſitum, atque ideo, ne libere poſſet incedere, retardabatur. Et quia ne ſic quidem recte currebat, Angelo illi illuſtri adoleſcenti harum rerum peritiſſimo dedi.'

"About this period alſo, mention is made of watches. Among the Italian poems of Gaſpar Viſconti, there is a ſonnet with the following title: 'Si fanno certi orologii piccioli e portativi, che non poco di artificio ſempre lavorano, moſtrando le ore, e molti corſi de pianeti, e le feſte, ſonando quando il tempo lo ricerca. Queſto ſonetto è facto in perſona de uno inamorato, che, guardando uno delli predicti orologii, compara ſe ſteſſo a quello, &c. *'

"It appears, therefore, that Doppelmayer is miſtaken when he ſays that watches were invented by

* This ſonnet I ſhall here tranſcribe from *Antonii Saxii Hiſt. litterario-typographica Mediolan.* prefixed to *Philippi Argelati Bibliotb. Scrip. Mediolanenſ.* i. p. 360.

Hò certa occulta forza in la ſecreta
Parte del cor, qual ſempre ſi lavora
De ſera a ſera, e d'una a l'altra aurora,
Che non ſpero la mente aver mai quieta.
Legger ben mi potria ogni diſcreta
Viſta nel fronte, ove amor colora
D'affanno e di dolore il punto e l'ora,
E la cagion, che ripoſar mi vieta.

L'umil

by Peter Hele, at Nuremberg, in the ſixteenth century; and that becauſe they were ſhaped like an egg, they were called *Nuremberg animated eggs**. I. Cocleus, in his *Deſcription of Germany* †, ſpeaking of this Hele, ſays: Eum juvenem adhuc admodum, opera efficere, quæ vel doctiſſimi admirentur mathematici. Nam ex ferro parva fabricat horologia plurimis digeſta rotulis, quæ, quocunque vertantur, abſque ullo pondere, et monſtrant et pulſant xl horas, etiam ſi in ſinu marſupiove contineantur.'

L'umil ſquilletta ſona il pio lamento,
Che ſpeſſo mando al cielo, e la fortuna,
Per disfogar cridando il fier tormento.
De le feſte annual non ne moſtro una,
Ma pianeti iracondi, e di ſpavento,
Eclipſati col ſole, e con la luna.

Dominico Maria Manni, in his book *de Florentinis inventis*, chap. 29, calls the artiſt Lorenzo a Vulparia; and ſays that he was a native of Florence.

* Nachricht von den Nürnbergiſchen mathematicis und künſtlern. Nurnberg 1730, fol. 289.

† Added to his *Comm. in Pomp. Melam*, cap. de Noriberga.

CLOCKS

CLOCKS AND WATCHES*.

THE term *Horologia* occurs very early in different parts of Europe; but as this word, in old times, ſignified dials as well as clocks, nothing deciſive can be inferred from it, unleſs it can be ſhewn by concomitant circumſtances or expreſſions, that it relates to a clock rather than a dial. Dante ſeems to be the firſt author who hath introduced the mention of an *orologio*, that ſtruck the hour, and which conſequently cannot be a dial, in the following lines:

Indi come horologio che *ne chiami*,
Nel hora che la ſpoſa d'Idio ſurge,
Amattinar lo ſpoſo, perche l'ami †.

Dante was born in 1265, and died in 1321, aged fifty-ſeven; ſtriking clocks therefore could not have been very uncommon in Italy, at the latter end of the thirteenth century or the beginning of the fourteenth.

* This article, written by the Hon. Daines Barrington, was tranſlated by profeſſor Beckman, from the *Archæologia*, vol. v. p. 416. It is here given from the original almoſt verbatim, with the addition of profeſſor Beckman's notes, tranſlated from the German, which are diſtinguiſhed by the initials of his name. TRANS.

† Dante, Paradiſo, c. x.

But

But the uſe of clocks was not confined to Italy at this period; for we had an artiſt in England about the ſame time, who furniſhed the famous clock-houſe near Weſtminſter Hall, with a clock to be heard by the courts of law, out of a fine impoſed on the Chief Juſtice of the King's Bench, in the ſixteenth year of Edward I, or in 1288*. Blackſtone in his Commentaries† has obſerved, that this puniſhment of Radulphus de Hengham is firſt taken notice of in the *Year Book* ‡, during the reign of Richard III, where indeed no mention is made of a clock being thus paid for; but if the circumſtances ſtated in the report of this caſe are conſidered, it was highly unneceſſary, and perhaps improper, to have alluded to this application of the Chief Juſtice's fine.

It appears by the *Year Book*, that Richard III had cloſeted the judges in the *Inner* Star Chamber, to take their opinions upon three points of law; the ſecond of which was, "Whether a juſtice of the peace, who had inrolled an indictment, which had been negatived by the grand-jury, amongſt the *true bills*, might be puniſhed for this abuſe of his office." On this queſtion a diverſity of opinion aroſe amongſt the judges, ſome of whom ſuppoſed that a magiſtrate could not be proſecuted for what

* See Selden, in his preface to Hengham.

† Vol. iii. p. 408.

‡ Mich. 2 Ric. III.

he might have done, whilſt others contended that he might, and cited the caſe of Hengham, who was fined eight hundred marks for making an alteration in a record, by which a poor defendant was to pay only ſix ſhillings and eight-pence, inſtead of thirteen ſhillings and four-pence. Thus far the anſwer of the judges to the queſtion was ſtrictly proper; but the application of the fine to build a clock-houſe was not the leaſt material *; beſides, that it was probably a moſt notorious fact to every ſtudent, upon his firſt attending Weſtminſter-hall, as we find judge Southcote, ſo much later, in the early part of queen Elizabeth's reign, not only mentioning the tradition, but that the clock ſtill continued there, which had been furniſhed out of the Chief Juſtice's fine †. Sir Edward Coke likewiſe adds, that the eight hundred marks were actually entered on the roll, ſo that it is highly probable he had himſelf ſeen the record ‡.

But we have remaining to this day ſome degree of evidence, not only of the exiſtence of ſuch a

* We find that this clock was conſidered, during the reign of Henry VI, to be of ſuch conſequence, that the king gave the keeping of it, with the appurtenances, to William Warby, dean of St. Stephen's, together with the pay of ſixpence per diem, to be received at the Exchequer. See *Stowe's Account of Weſtminſter*, vol. ii. p. 55. The clock at St. Mary's, Oxford, was alſo furniſhed in 1523, out of fines impoſed on the ſtudents of the univerſity.

† III Inſt. 72.

‡ IV Inſt. p. 255.

clock,

clock, but that it is of the antiquity already aſcribed to it, viz. the reign of Edward I. On the ſide of New Palace-yard, which is oppoſite to Weſtminſter-hall, and in the ſecond pediment of the new buildings from the Thames, a dial is inſerted with this remarkable motto upon it, *Diſcite juſtitiam moniti*, which ſeems moſt clearly to relate to the fine impoſed on Radulphus de Hengham being applied to the paying for a clock. But it may be ſaid that that this inſcription is on a dial and not upon a clock; which, though it appears upon the firſt ſtating it to be a moſt material objection, yet I conceive it may receive the following ſatisfactory anſwer. The original clock of Edward the firſt's reign was probably a very indifferent one, but from its great antiquity, and the tradition attending it, was ſtill permitted to remain till the time of queen Elizabeth, according to the authorities already cited. After this, being quite decayed, a dial might have been ſubſtituted and placed upon the ſame clock-houſe, borrowing its very ſingular motto; which, whether originally applied in the time of Edward I, or in later reigns, moſt plainly alludes to Hengham's puniſhment for altering a record. It ſhould alſo be mentioned, that this dial ſeems to have been placed exactly where the clock-houſe ſtood according to Strype *.

* Weſtminſter, p. 55. in his Additions to Stow. This clock-houſe continued in a ruined ſtate till the year 1715. *Antiquarian Repertory*, p. 280.

Mr.

Mr. Norris, ſecretary to the Society of Antiquaries, hath been likewiſe ſo obliging as to refer me to the following inſtance of a very ancient clock in the ſame century: *Anno* 1292, *novum orologium magnum in eccleſia* (Cantuarienſi), *pretium* 30l. *

I ſhall now produce a proof, that not only clocks but watches were made in the beginning of the fourteenth century. Seven or eight years ago, ſome labourers were employed at Bruce Caſtle, in Fifeſhire, where they found a watch, together with ſome coin, both of which they diſpoſed of to a ſhopkeeper of St. Andrews, who ſent the watch to his brother in London, conſidering it as a curious piece of antiquity †. The outer caſe is ſilver, raiſed, in rather a handſome pattern, over a ground of blue enamel; and I think I can diſtinguiſh a cypher of R. B. at each corner of the enchaſed work. On the dial-plate is written, *Robertus B. Rex Scotorum*, and over it is a convex tranſparent horn, inſtead of the glaſſes which we uſe at preſent. Now *Robertus B. Rex Scotorum* can be no other king of Scotland than Robert Bruce, who began his reign in 1305, and died in 1328; for the chriſtian name of Baliol, who ſucceeded him, was Edward; nor can *Robertus B.* be applied to any later Scottiſh king. This very ſingular watch is not of a

* Dart's Canterbury, appendix, p. 3, ex Bibl. Cotton. Galba, E. 4, fol. 103.

† It is now in his majeſty's poſſeſſion.

larger

larger ſize than thoſe which are now in common uſe; at which I was much ſurpriſed till I had ſeen ſeveral of the ſixteenth century in the collection of Sir Aſhton Lever, and Mr. Ingham Forſter, which were conſiderably ſmaller.

As I mean to deduce the progreſs of the art of clock-making in a regular chronological ſeries, the next mention I find of *horologia* is in *Rymer's Fœdera*, where there is a protection of Edward III, in the year 1368, to three Dutchmen, who were *Orlogiers*. The title of this protection is, *De horologiorum artificio exercendo*; and I hope to have ſufficiently proved that there was no neceſſity of procuring mere dial-makers at this time.

Clock-makers however were really wanted at this period of the fourteenth century, as may be inferred from the following lines of Chaucer, when he ſpeaks of a cock's crowing:

> Full ſikerer was his crowing in his loge,
> As is a *clock*, or any abbey orloge *.

By which, as I conceive at leaſt, our old poet means to ſay, that the crowing was as certain as a *bell*, or abbey-*clock* †. For though we at preſent aſk ſo often

* Chaucer was born in 1328, and died in 1400.

† To the time of queen Elizabeth clocks were often called *orologes*:

> He'll watch the *horologe a double ſet*,
> If drink rock not his cradle.
>
> *Othello*, act ii. ſc. 3.

By

often, What is it *o'clock?* meaning the time-meaſurer, yet I ſhould rather ſuppoſe, that in the fourteenth century the term *clock* was often applied to a *bell*, which was rung at certain periods, determined by an hour-glaſs or a ſun-dial. Nor have I been able to ſtumble upon any paſſage which alludes to a clock, by that name, earlier than the thirteenth year of the reign of Henry VIII *. The abbey *orloge* (or clock) however muſt have been not uncommon when Chaucer wrote theſe lines; and from clocks beginning to be in uſe we might have had occaſion for more artificers in this branch, though it ſhould ſeem that we had Engliſhmen, who pretended at leaſt to underſtand it, becauſe the protection of Edward III, above cited, directs that the perſons to whom it was granted, ſhould not be moleſted whilſt they were thus employed.

I now paſs on to a famous aſtronomical clock, made by one of our countrymen in the reign of

---

By which the double ſet of twelve hours on a clock is plainly alluded to, as not many more than twelve can be obſerved on a dial; and in the ſame tragedy this laſt time-meaſurer is called by its proper name:

More tedious than the dial eight ſcore times.

Ibid. act iii. ſc. 4.

The clock of Wells cathedral is alſo, to this day, called the *horologe*.

* See *Dugdale's Origines Jurid.* Lydgate, therefore, who wrote before the time of Henry VIII, ſays:

I will myſelf be your *orologere*
To-morrow early.

Prologue to the Storye of Thebes.

Richard II, the account of which I have extracted from Leland. Richard of Walingford was ſon of a ſmith, who lived at that town, and who, from his learning and ingenuity, became abbot of St. Alban's. Leland, ſpeaking of him, ſays: 'Cum jam per amplas licebat fortunas, voluit illuſtri aliquo opere, non modo ingenii, verum etiam eruditionis, ac artis excellentis, miraculum oſtendere. Ergo talem *horológii* fabricam magno labore, majore ſumtu, arte vero maxima, compegit, qualem non habet tota Europa, *mea opinione*, ſecundam, ſive quis curſum ſolis ac lunæ, ſeu fixa ſidera notet, ſive iterum maris incrementa et decrementa *.' Richard of Walingford wrote alſo a treatiſe on this clock, 'ne tam inſignis machina vileſceret errore monachorum, aut incognito ſtructurae ordine ſileſceret.' From what hath been above ſtated, it appears that this aſtronomical clock continued to go in Leland's time, who was born at the latter end of Henry the ſeventh's reign, and who ſpeaks of a tradition, that this famous piece of mechaniſm was called *Albion* by the inventor.

Having thus endeavoured to prove that clocks were made in England from the time of Edward I to that of Richard II; it is not eſſential to my principal purpoſe to deduce them lower through the ſucceſſive reigns; but when I have ſhortly

* Leland de Script. Brit.

ſtated what I happen to to have found with regard to this uſeful invention in other parts of Europe, I ſhall attempt to ſhew why they were not more common in the thirteenth and fourteenth centuries.

The citation from Dante, which I have before relied upon, ſhews, that they were not unknown in Italy during that period; and Mr. Falconet, in *Mémoires de Litterature*, informs us, that a James Dondi, in the fourteenth century, aſſumed from a clock made by him for the tower of a palace, the name of *Horologius*, which was afterwards borne by his deſcendants.

In France, or what is now ſo called, Froiſſart mentions, that during the year 1332 Philip the Hardy, duke of Burgundy, removed from Courtray to his capital at Dijon a famous clock which ſtruck the hours, and was remarkable for its mechaniſm *. The great clock at Paris was put up in the year 1370, during the reign of Charles V, having been made by Charles de Wic †, a German. Carpentier, in his ſupplement to Du Cange, cites a deciſion of the parliament of Paris in the year 1413, in which Henry Bye, one of the parties, is ſtyled *Gubernator Horologii palatii noſtri Pariſiis* ‡. About

* Froiſſart, vol. ii. ch. 127.

† Falconet, Mémoires de Litt. vol. xx.

‡ See Carpentier, art. *Horologiator*.

the

the ſame time alſo the clock at Montargis was made, with the following inſcription:

Charles le Quint (ſc. de France)
Me fit par Jean de *Jouvence*.

The laſt word ſeems to be the name of a Frenchman.

Though I have not happened to meet with any mention of very early clocks in Germany, yet from the great clock at Paris in 1370 being the work of De Wic, as alſo from the protection granted by Edward III to three clock-makers from Delft, it ſhould ſeem that this part of Europe* was not without this uſeful invention, and the ſame may be

* Mr. Peckett, an ingenious apothecary of Compton Street, Soho, hath ſhewn me an aſtronomical clock which belonged to the late Mr. Ferguſon, and which ſtill continues to go. The workmanſhip on the outſide is elegant, and it appears to have been made by a German in 1525, by the ſubjoined inſcription in the Bohemian of the time:

Iar. da. macht. mich. Iacob. Zech.
Zu. Prag. iſt. bar. da. man. zalt. 1525.

The above Engliſhed.
Year. when. made. me. Jacob. Zech.
At. Prague. is. true. when. counted. 1525.

The diameter of the clock is nine inches three fourths, and the height five inches.

[I have tranſpoſed the words, as I find them in the original; but *war* ſeems to have ſtood in the place of *bar*, at leaſt Barrington has tranſlated it by *is true*, and we muſt read:

Da man zält 1525 *jar*
Da macht mich Iacob Zech zu Prag iſt wahr.—I. B.]

inferred with regard to Spain from the old saying: *Estar como un relox* *.

Having now produced instances of several clocks, and even a watch, which were made in different parts of the fourteenth century, as also having endeavoured to prove that they were not excessively uncommon even in the thirteenth, it may be thought necessary that I should account for their not being more generally used during those periods, as, in their present state at least, they are so very convenient. For this it should seem that many reasons may be assigned.

In the infancy of this new piece of mechanism, they were probably of a very imperfect construction, perhaps never went tolerably, and were soon deranged, whilst there was no one within a reasonable distance to put them in order. To this day the most musical people have seldom a harpsichord in their house, if the tuner cannot be procured from the neighbourhood. We find therefore that Henry VI of England, and Charles V of France, appointed clock-makers, with a stipend, to keep the Westminster and Paris clocks in order.

* I am also referred by the Rev. Mr. Bowle, F. S. A. to the following passage in the *Abridged History of Spain*, vol. i. p. 568: "The first clock seen in Spain was set up in the cathedral of Seville, 1400."

It need ſcarcely be obſerved alſo, that, as the artiſts were ſo few, their work muſt have been charged accordingly, and that kings only could be the purchaſers of what was rather an expenſive toy, than of any conſiderable uſe. And it may perhaps be ſaid, that they continued in a great meaſure to be no better than toys, till the middle of the ſeventeenth century. Add to this, that in the thirteenth and fourteenth centuries, there was ſo little commerce, intercourſe, or ſociety, that an hour-glaſs, or the ſun, was very ſufficient for the common purpoſes, which are now more accurately ſettled by clocks of modern conſtruction. Dials and hour-glaſſes likewiſe wanted no mending.

Having now finiſhed what hath occurred to me with regard to the firſt introduction of clocks, I ſhall conclude by a few particulars, which I have been enabled to pick up, in relation to thoſe more portable meaſurers of time, called *watches*, the earlieſt of which, except that of Robert Bruce, king of Scotland, ſeems to be one in Sir Aſhton Lever's moſt valuable muſeum, the date upon which is 1541*.

Derham, in his *Artificial clock-maker* †, publiſhed

* The oldeſt clock we have in England that is ſuppoſed to go tolerably, is of the preceding year, viz. 1540, the initial letters of the maker's name being *N. O.* It is in the palace at Hampton Court. *Derham's Artificial clock-maker.*

† A German tranſlation of this book is added to *Welper's Gnomick* I. B.

in 1714, mentions a watch of Henry VIII which was ſtill in order; and Dr. Demainbray informs me, that he hath heard both Sir Iſaac Newton and Demoivre ſpeak of this watch *. The emperor Charles V, Henry's cotemporary, was ſo much pleaſed with theſe time-meaſurers, that he uſed to ſit after his dinner with ſeveral of them on the table, his bottle being in the centre †; and when he retired to the Monaſtery of St. Juſt, he continued ſtill to amuſe himſelf with keeping them in order, which is ſaid to have produced a reflection from him on the abſurdity of his attempt to regulate the motions of the different powers of Europe.

Some of the watches uſed at this time, ſeem to have been ſtrikers; at leaſt we find in the *Memoirs of Literature*, that ſuch watches having been ſtolen both from Charles V and Lewis XI whilſt they were in a crowd, the thief was detected by their ſtriking the hour ‡. In moſt of the more ancient watches, of which I have ſeen ſeveral in the collection of Sir Aſhton Lever and Mr. Ingham Forſter,

* That diſtinguiſhed antiquary Mr. Walpole has in his poſſeſſion a clock, which appears by the inſcription to have been a preſent from Henry VIII to Anne Boleyn. Poynet, biſhop of Wincheſter, likewiſe gave an aſtronomical clock to the ſame king. *Godwyn de Præſul.*

† Mémoires de Litt. vol. xx. See alſo the lately publiſhed *Collection of State Papers*, vol. i. p 53.

‡ Vol. xx.

catgut

catgut ſupplied the place of a chain *, whilſt they were commonly of a ſmaller ſize than we uſe at preſent, and often of an oval form †.

From theſe and probably many other imperfections, they were not in any degree of general requeſt, till the latter end of queen Elizabeth's reign. Accordingly in Shakeſpeare's Twelfth Night Malvolio ſays: "I frown the while, and perchance *wind up my watch*, or play with ſome rich jewel." Again, in the firſt edition of Harrington's *Orlando Furioſo*, printed in 1591, the author is repreſented with what ſeems to be a watch, though the engraving is by no means diſtinct, on which is written *Il tempo paſſa* ‡.

* A clockmaker of this city (Gottingen) aſſured me that ſeveral watches which had catgut inſtead of a chain, were brought to him to be repaired. *I. B.*

† Barrington ſays here, in a note, "Pancirollus informs us, that about the end of the fifteenth century watches were made no larger than an almond, by a man whoſe name was Mermecide. *Encyclop.*" The firſt part of this aſſertion is to be found, indeed, in Pancirollus, edition of Franckfort 1646, 4to. ii. p. 168; but Myrmecides was an ancient Greek artiſt, whoſe παραναλωματα, or uncommonly ſmall pieces of mechaniſm, are ſpoken of by Cicero and Pliny. He is not mentioned by Pancirollus, but by Salmuth, p. 231. It is probable that this error may be in the *Encyclopédie*; at leaſt Barrington refers to it, as his authority. I. B.

‡ Somner's Canterbury, Supplement, no. xiv. p. 36. See alſo, in an extract from archbiſhop Parker's will, made April 5th 1575: Do et lego fratri meo Ricardo epiſcopo Elienſi baculum meum de canna Indica, qui *horologium* habet in ſummitate. As likewiſe in the brief of his goods, &c. no. xiv. p. 39, A clock valued at 54 l. 4 s.

In the third year of James I, a watch was found upon Guy Fawkes, which he and Percy had bought the day before, "to try concluſions for the long and ſhort burning of the touchwood, with which he had prepared to give fire to the train of powder *."

In 1631, Charles I incorporated the clockmakers; and the charter prohibits *clocks*, *watches*, and *alarms*, from being imported: which ſufficiently proves that they were now more commonly uſed, as well as that we had artiſts of our own who were expert in this branch of buſineſs.

About the middle of the ſeventeenth century, Huygens made his great improvement in clockwork, which produced many others from our own countrymen †; the lateſt of which was the introduction of repeating watches, in the time of Charles II, who, as I have been informed by the late lord Bathurſt, ſent one of the firſt of theſe new inventions to Lewis XIV. The former of theſe kings was very curious with regard to theſe time-meaſurers; and I have been told by an old perſon of the trade, that watchmakers, particularly Eaſt, uſed to attend whilſt he was playing at the Mall; a watch being often the ſtake.

* Stow's Chron. p. 878; and Introduct. to Mr. Reuben Burrow's Almanac for 1778.

† More particularly Dr. Hook, Tompion, &c.

But

But we have a much more curious anecdote of royal attention to watches in Dr. Derham's *Artificial clock-maker* *. Barlow had procured a patent, in concert with the Lord Chief Juſtice Allebone, for *repeaters*; but Quare making one at the ſame time upon ideas he had entertained before the patent was granted, James II tried both, and giving the preference to Quare's, it was notified in the gazette. In the ſucceeding reign, the reputation of the Engliſh work in this branch was ſuch, that in the year 1698, an act paſſed, obliging the makers to put their names on watches, leſt diſcreditable ones might be ſold abroad for Engliſh †.

Letter on the pretended Watch of King Robert Bruce ‡.

You will remember that I formerly mentioned ſomething to you in reference to the obſervations made by the Hon. Daines Barrington, on the earlieſt

* Derham's Artificial clock-maker, p. 107.

† The Ninth and Tenth of William III, ch. 28. ſ. 2.

‡ This letter, ſigned John Jamieſon, and dated Forfar, Auguſt 20th, 1785, was tranſlated into German from the *Gentleman's Magazine* for the before-mentioned year, vol. ii. p. 688. It is here given verbatim from that publication, as the original muſt undoubtedly be preferable to a tranſlation from a tranſlation. The two notes, with the ſignature B, are by Profeſſor Beckman. TRANS.

One of my literary friends in London, to whom I am indebted for much learned information, ſays, in a letter which I received from him: "I had never believed the ſtory of Robert Bruce's watch, mentioned in your tranſlation of Barrington's Hiſtory of clocks, the more as Mr. Barrington is famous for being in the wrong; but in the Gentleman's Magazine

lieſt introduction of clocks, publiſhed in the Annual Regiſter for 1779, under the article Antiquities, p. 133. According to your deſire, I will communicate what circumſtances come within my perſonal knowledge, about a watch that correſponds very much to one deſcribed by him as once the property of king Robert Bruce. I muſt be indulged although in ſome particulars I cannot ſpeak with abſolute certainty, as ſo much time hath elapſed ſince the tranſaction I am going to relate.

Being early fond of any thing ancient or uncommon, I uſed to purchaſe pieces of old coin from a goldſmith who wrought privately in Glaſgow, and ſometimes went about as a hawker. Having often aſked him, from the curioſity of a boy, if he had ever been at the caſtle of Clackmannan, or heard of any antiquities being found there; he told me that he had purchaſed from Mrs. Bruce, who is the only ſurvivor of that ancient family in the direct line, an old watch, which was found in the caſtle, and had an inſcription, bearing, that it belonged to king Robert Bruce. I immediately aſked a ſight of it; but he told me it was not at hand. He fixed a time for ſhewing me this invaluable curioſity; but even then it could not be ſeen. My avidity produced many anxious calls,

Magazine there is a full account of the origin of this impoſition." As this error occurs in a paper which I have endeavoured to render more public by a tranſlation, I conſider myſelf bound to give a tranſlation of this letter alſo. B.

although by that time I began to ſuſpect he meant to play upon me, eſpecially as I did not think it altogether credible that Mrs. Bruce would ſell ſuch a relique of her family if ſhe had ever had it in her poſſeſſion. At length I was favoured with a ſight of it. The watch, as far as I can recollect, almoſt entirely anſwered the one deſcribed. It had a ground of blue enamel. It had a horn above the dial-plate inſtead of a glaſs. The inſcription was on the plate. But whether it was *Robertus B.* or *Robertus Bruce*, I cannot remember. The watch was very ſmall and neat, and ran only, to the beſt of my knowledge, little more than twelve hours, at leaſt not a complete day. The Hon. Mr. Barrington does not mention any thing about this circumſtance. It is about twelve years ſince I ſaw it. Whether there be any caſtle in Fife, properly called Bruce caſtle, I know not; but the caſtle of Clackmannan hath always been the reſidence of the eldeſt branch of the family; and although the town in which it ſtands now gives name to a ſmall county, yet in former times, and ſtill in common language, that whole diſtrict receives the name of Fife, as diſtinguiſhing it from the county on the other ſide the firths of Forth and Tay. The firſt thing that occurred to me about the watch itſelf, was in regard to the inſcription. Obſerving that all the coins of king Robert's age bore Saxon characters, I could not believe the inſcription to be genuine, becauſe the characters

were

were not properly Saxon, but a kind of rugged Roman, or rather Italic characters, like thoſe commonly engraved, but evidently done very coarſely, to favour the impoſition. He valued it at 1 l. 10 s. but I would have nothing to do with it. The firſt time I had an opportunity of ſeeing Mrs. Bruce of Clackmannan, after this, I aſked her if ſuch a watch had ever been found. She told me that ſhe never ſo much as heard of any ſuch thing. This confirmed the juſtneſs of my ſuſpicion.

I paid no farther regard to this ſtory till about ſeven years ago, when I received a letter from a friend, informing me, that a brother of his in London, who had a taſte for antiquity, had deſired him, if poſſible, to procure ſome intelligence from Glaſgow about a watch, ſaid to be king Robert Bruce's, which had thence found its way to London, and was there making a great noiſe among the antiquaries. I then applied to my former goldſmith, who was then in a more reſpectable way, and mentioned the old ſtory. He immediately fell a-laughing, and told me, that he did it merely for a piece of diverſion, and thought the ſtory would take with me, as I had been often aſking about the place. He ſaid that it was an old watch brought from America; that, to get ſome ſport with my credulity, he had engraved the inſcription upon it in a rough, antiquated-like form; that he had afterwards

afterwards ſold it for two guineas; he had learned that it was next ſold for five, and had never more heard of it.

However early the invention of clocks might be, I am greatly miſtaken if any authentic documents can be produced of the art of making pocket-watches being diſcovered ſo early as the beginning of the fourteenth century. Lord Kaimes, ſomewhere in his *Sketches of Man*, aſſerts, that the firſt watch was made in Germany, ſo far as I can remember, near the cloſe of the fifteenth *. If any watch had been made ſo early as R. Bruce's time, it is moſt likely the inſcription would have been in Saxon characters, as not only the money both of Scotland and England but of Germany, in that age, bears a character either Saxon, or greatly reſembling it.

If Mr. Urban thinks theſe obſervations worthy a place in his valuable magazine, they can in that channel be communicated to the public, and ſubmitted to the attention of thoſe who may have an opportunity of examining the affair in queſtion with greater accuracy. Whatever ardour one feels for any thing that bears the genuine marks of antiquity, it is certainly a debt he owes to thoſe who

* The paſſage may be found, vol. i. p. 95. of the edition in quarto, Edinburgh 1774: "Pocket watches were brought there from Germany, an. 1577." Home, or Lord Kaimes, however, was too celebrated or too artful a writer to produce proofs of his hiſtorical aſſertions. B.

have

have the ſame taſte, to contribute any thing in his power that may prevent impoſitions, to which antiquaries are abundantly ſubject, through the low humour or avarice of others; or that may tend to confirm a fact by proper compariſon and minute inveſtigation of circumſtances. Beſides, this is of greater moment than ſettling the genuineneſs of a coin, or many other things of the ſame nature, becauſe it involves in it the date of a very important diſcovery. It doth not merely refer to the hiſtory of an individual, or even of one nation, but to the hiſtory of man. It reſpects the progreſs of the arts; and an anachroniſm here is of conſiderable importance, becauſe, being eſtabliſhed upon a ſuppoſed fact, it becomes a precedent for writers in future ages.

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END OF THE FIRST VOLUME.